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A NEW PHILIPPINE SEA ROBIN, FAMILY PERISTEDIIDÆ

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ONE PLATE

The deep-water sea robins are very strange-looking and imperfectly known fishes which live ordinarily in rather deep water. They are related to the gurnards, but their specialization has gone much further. The plowlike head is of enormous size in proportion to the body, and is completely inclosed with plates of bone which form a weird armor resembling that of some of the giant Devonian invertebrates; each preorbital is produced into a long flat process which extends on each side beyond the snout; the mouth is large, inferior, and may be toothless, or may have very fine teeth on the upper jaw; the lower jaw is provided with two or more pairs of barbels.

The trunk is elongate, tapering, and covered with bony plates, each of those on the top and sides armed with a strong backward-pointing spine; the dorsal fin may be continuous or divided; the pectoral fin is short or of moderate length, with the two lowermost rays detached, thickened, and fingerlike; the ventrals are I, 5, and are separated by broad flat bony plates which form the surface of the belly; the gill membranes are separate and narrowly joined to the isthmus anteriorly; the gill rakers are slender; an anal papilla is present; the air bladder is simple; there are about ten pyloric cæcæ.

These fantastic fishes, which somewhat resemble young sturgeons, are usually red. Their flat ventral surface is perfectly adapted to life on smooth surfaces at considerable depths. The

free rays of the pectorals are used to turn over stones and mollusks in their search for food. Five or six genera are known, with about two dozen species, occurring in the Indo-Australian, Chinese, and Japanese seas, the tropical Atlantic, and the Mediterranean Sea.

Three genera are known from the Philippines, two new genera having been described from the *Albatross* collections by H. M. Smith. Smith's arrangement of the Philippine genera is here followed.

Key to the Philippine genera of Peristediidae.

- a¹. Both jaws toothless..... Peristedion.
- a². Upper jaw with teeth; lower jaw toothless.
 - b¹. Head shield much expanded, flattened, with crenate margin; rostral processes long and flat; barbels highly developed; mouth medium; teeth on premaxillaries in a broad band reaching halfway to angle of mouth Gargariscus.
 - b². Head shield little expanded, with entire margin; rostral processes short, spinelike, not flat; barbels short and few; mouth very large; teeth on premaxillaries in a broad band reaching to angle of mouth. Heminodus.

Genus PERISTEDION Lacépède

Peristedion LACÉPÈDE, Hist. Nat. Poissons 3 (1802) 368.

Peristethus KAUP, Proc. Zool. Soc. London (1859) 103; amended spelling.

Barbels on lower lip and jaw large, forming a long fringed tuft at angles of mouth; in other respects the characters are included above.

A single species, here described as new, is known from the Philippines. Of the sixteen species previously described from Indo-Pacific waters, the Philippine species is closest to *P. rieffeli*.

Peristedion welchi sp. nov. Plate 1.

Dorsal, VII-18; anal, 18; pectoral, II-12; lateral line, 32.

The elongate octagonal body is covered on each side by three series of scalelike armor plates, each of which bears a sharp backward-pointed spine; all the plates are very much broader than long; the dorsal and ventral plates form a concave depression in which the vertical fins are placed; its depth equals its breadth and is contained 5.46 times in the length from tip of snout to posterior end of lateral line; the greatest width of the very large, roughly triangular head is 0.9 of its length from nape to tip of snout and $\frac{7}{8}$ of its true length, namely, from origin of lateral line to tip of snout; length of head con-

tained 2.85 times in head and trunk together; greatest depth of head almost equal to that of body but is approximately only $\frac{4}{7}$ of its own breadth; the large eyes contained 4.36 times in head and 2.5 times in snout; interorbital space is made strongly concave by the broad elevated supraorbital ridges; its breadth is $\frac{10}{11}$ of the length of eye and is contained 4.8 times in head; the snout proper contained about 1.75 times in head; the flat, minutely serrate and convergent prolongations of preorbital extend beyond and partially inclose snout and are $\frac{1}{4}$ as long as head; their length is contained approximately 3.2 times in the distance from eye to their tips; they are continued posteriorly in a flat prominent ridge which ends in a spine that does not extend back as far as the two unequal opercular spines.

The crown is quadrangular and crossed at right angles by two strongly marked sutures; the posterior plates each have a prominent backward-pointing spine; a small spine on each supraorbital ridge at the forward boundary of crown; in the middle of forehead is a triangular spine, from which four ridges radiate like an X, two into the interorbital space and terminating in the supraorbital spines, the other two toward the snout and likewise each terminating in a small triangular spine; in front of each eye at base of supraorbital ridge is a similar but still smaller spine; the surface of all the head cuirass is pitted and sculptured.

On the lower lip are three pairs of barbels, the outer ones very long and branched, the others simple; behind each of the innermost pair of barbels are two smaller ones and behind each of the middle pair is another much smaller one; opposite posterior angle of jaws is a pair of barbels smaller than any of the others.

Two pairs of abdominal plates before vent; those of the first pair have an anterior prolongation and a shallow notch on the posterior margin; the length is $\frac{1}{2}$ greater than the breadth; the second pair is wider than long, with the posterior notch more marked than in the first.

First and second dorsals both low, the longest spines and rays being about 1.5 times eye; anal still lower; pectoral reaches to twelfth scale of lateral line; ventrals extend as far as anus but not to genital opening or papilla; the upper rays of caudal are longest, its length approximately twice that of eye.

Color above in alcohol is pale gray-brown, with the sutures of dorsal plates all marked by broad brown lines; carapace of head nearly uniform reddish gray; underparts uniform pale

yellow; first and second dorsals sparsely sprinkled with small circular spots; anal black-edged; pectorals uniform blackish gray; caudal yellowish. Lines of fine circular shallow pits radiate from spine on each of the dorsal plates, the bottom of each pit dark. In life at least the upper surface of this fish is probably red.

This species is close to *P. rieffeli* Kaup, but differs from the description and figure of the author and the more elaborate diagnosis by Günther. *Peristedion rieffeli* has three abdominal plates before the vent, only two pairs of barbels, and the proportions of the head and body are different. There are also marked differences in the dorsal and anal fins and in the number, size, and shape of the various spines on the armor of the head.

The type and only specimen was caught in a fish corral on the reef in front of Dumaguete, Oriental Negros, in water not more than 6 or 8 meters deep. Its length is 284 millimeters to the tip of the snout, or 308 millimeters including the pre-orbital processes; adding the caudal fin, the length over all is 351 millimeters.

I take pleasure in naming this species for Thomas Cary Welch, as an appreciation of his interest in scientific matters and the assistance he has given in my studies of Philippine fishes.

ILLUSTRATION

PLATE 1. *Peristedion welchi* sp. nov., dorsal, ventral, and lateral views.

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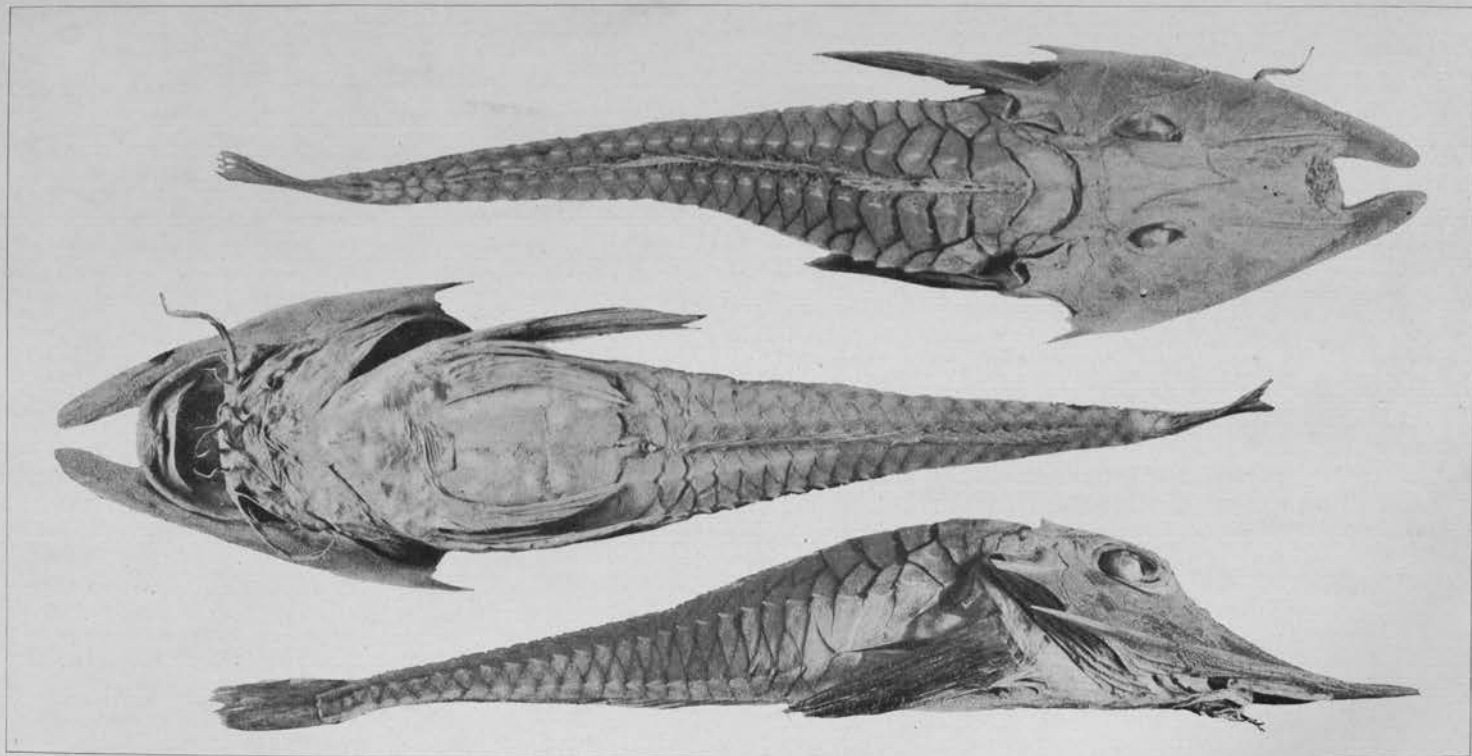


PLATE 1. PERISTEDION WELCHI SP. NOV.

NOTES ON THE CHLORINATION OF THE MANILA WATER SUPPLY

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TWO PLATES AND TWO TEXT FIGURES

The water supplied to the City of Manila was treated for the first time with calcium hypochlorite during the dry months of the year 1912, when water of doubtful quality had to be taken from Mariquina River at Santolan, owing to insufficiency of the river flow at Montalban. The quantity of hypochlorite used was equivalent to about 0.33 part of free chlorine per million parts of water. It appears that no study was made to determine the effect of the treatment, which was discontinued at the end of the dry season.

In 1914 the treatment was resumed and has since then been continued, practically without interruption, on the entire body of water supplied to Manila throughout the year.

FORMER STUDIES

Heise,¹ formerly of the Bureau of Science, made a series of observations in 1914 to study the effect of the hypochlorite treatment on the bacterial content of the city water. He used amounts of disinfectant that varied from 0.5 to 0.75 part of free chlorine per million parts of water. Heise's experiments, which were limited to the months of June and July, gave the following results:

By using a fixed dose of 0.5 part per million (parts available chlorine per million parts of water) a bacterial reduction of less than 50 per cent was effected. A dose of 0.625 part per million gave an average bacterial reduction of 63 per cent. With a dose of 0.75, the bacterial reduction was 65 per cent. With reference to these results Heise states:

It is interesting to note the greatly increased efficiency of 0.625 part of available chlorine per million as compared with 0.5 and the relatively slight increase in efficiency of 0.75 over 0.625.

¹ Philip. Journ. Sci. § A 11 (1916) 1.

FORMER CHLORINATION PRACTICE

It seems that, in view of the above results, an invariable dose of about 0.6 part per million was adopted and used with subsequent slight changes in chlorinating the Manila water supply from 1914 until the middle of 1923. Although this plan was not giving very satisfactory results, it was the most expedient that could be carried out uninterruptedly under the attendant circumstances.

One of the disturbing features of this treatment was the intermittent and irregular appearance of residual chlorine in the treated water, as shown in Table 1, which gives some of the results of frequent tests made by the Bureau of Science.

It appears also from Heise's studies and from additional data on record that the bacterial reduction accomplished with the treatment with an invariable dose of chlorine was generally low. Some results of the former treatment are given in Table 2. Two samples of the treated water from different places and one sample of the untreated water from the reservoir were examined daily and the percentage of bacterial reduction was computed from the colony counts. The figures in Table 2 are the averages of the daily results obtained by the biological laboratory of the Bureau of Science.

TABLE 2.—*Bacterial reduction with former treatment used in 1919 and 1921.*

| Date. | Average reduction. | |
|----------------|--------------------|-----------------------|
| | At San Juan. | At Bureau of Science. |
| | Per cent. | Per cent. |
| 1919 | | |
| May..... | 54 | 45 |
| June..... | 43 | 29 |
| July..... | 43 | 48 |
| August..... | 47 | 77 |
| September..... | 63 | 79 |
| November..... | 63 | 60 |
| December..... | 63 | 66 |
| 1921 | | |
| January..... | 60 | 53 |
| February..... | 76 | 67 |
| April..... | 66 | 50 |
| May..... | 64 | 56 |

A ready explanation for the low efficiency of the treatment can be found in the changeable chlorine-consuming capacity of

the water from Montalban. Heise² reports chlorine consumption varying from 0.5 to 1 part per million with a contact period of one hour in samples of the unchlorinated water taken on different days. Recent work has shown the variation to be greater; namely, from 0.4 to 1.4 parts per million with a contact period of about four hours. It can be easily understood, therefore, why the dose of 0.6 part per million that was generally used imparted at times a disagreeable odor to the water and on other occasions produced inefficient sterilization.

The method of applying the hypochlorite solution to the water was in all probability partly responsible for the unsatisfactory results derived from the treatment. At certain times of the day irregularities in dosing the water could occasionally be detected. There have been cases in which the quantity of residual chlorine in the treated water exceeded the dose that was supposed to have been applied. Such a result could not have been obtained unless the workers at the chlorination plant made errors in the measurement of the volume of the hypochlorite solution or in the determination of its strength. The rather crude equipment formerly used did not very well admit of accurate operations.

At any rate, it can be confidently stated that the shortcomings of the invariable dosage plan of chlorination, coupled with irregularities in dosing the water, rendered the former treatment low in efficiency. These unsatisfactory conditions made it necessary to introduce better equipment for chlorination and to put the treatment under careful supervision and control.

PRESENT SYSTEM OF CHLORINATION

In order to accomplish efficient sterilization, the dose of chlorine needs to be constantly adjusted and changed to meet the varying demands of the water. It is along this line that the Manila water supply is being chlorinated at present.

The main factors entering into the laboratory control of the treatment are the quantity of residual chlorine, the colony counts, the presence of *Bacillus coli*, and the turbidity.

RESIDUAL CHLORINE

A certain amount of residual chlorine is maintained at all times in the treated water all over the distribution system. Efforts are made to keep this amount between 0.05 and 0.1 part

² Philip. Journ. Sci. § A 11 (1916) 11.

per million by regulating the dosage at the chlorination plant. Tests of the tap water are made several times a day at the laboratory in the city and, to insure complete chlorination, tests are occasionally made of the water in the suburbs of the city and at the dead ends of the system. The orthotolidine test³ for free chlorine is used. Table 3 shows some results of such examinations including the colony counts and the presumptive tests for *B. coli*.

TABLE 3.—*Examination of water at different points of the Manila water system.*

| Tap or hydrant at— | Residual chlorine, parts per million. | | | Colonies per cubic centimeter. | | |
|-------------------------|---------------------------------------|-----------------|-----------------|--------------------------------|-----------------|-----------------|
| | February 23, 1924. | March 12, 1924. | April 23, 1924. | February 23, 1924. | March 12, 1924. | April 23, 1924. |
| Bureau of Science..... | 0.1 | 0.15 | 0.1 | 2 | 26 | 120 |
| End of Vito Cruz..... | 0.07 | 0.05 | 0.08 | 32 | 34 | 480 |
| Teheron, Santa Ana..... | 0.09 | 0.1 | 0.1 | 80 | 12 | 88 |
| Maypajo Bridge..... | 0.06 | 0.07 | 0.05 | 40 | 125 | 325 |
| End of Velazquez..... | 0.05 | 0.05 | 0.06 | 82 | 105 | 52 |
| End of Economia..... | 0.15 | 0.25 | 0.1 | 30 | 8 | 48 |

| Tap or hydrant at— | Presumptive test in 10 cubic centimeters. | | |
|-------------------------|---|-----------------|-----------------|
| | February 23, 1924. | March 12, 1924. | April 23, 1924. |
| Bureau of Science..... | Negative..... | Negative..... | Negative. |
| End of Vito Cruz..... | do..... | do..... | Do. |
| Teheron, Santa Ana..... | do..... | do..... | Do. |
| Maypajo Bridge..... | do..... | do..... | Do. |
| End of Velazquez..... | do..... | do..... | Do. |
| End of Economia..... | do..... | do..... | Do. |

The dose of chlorine to be given to the water is determined from the amount of hypochlorite (of known strength) being used and the corresponding quantity of residual chlorine. If the latter is between 0.05 and 0.1 part per million no change is made in the dose. If the quantity of residual chlorine becomes too small or too large, the dose is changed accordingly. Thus the dose for any period is dependent on the results of the period immediately preceding.

BACTERIA

In the event that the number of bacteria per cubic centimeter is found to be unusually high, an additional dose of chlorine is

³ Ellms and Hauser, Journ. Ind. & Eng. Chem. 5 (1913) 915.

used. This precaution is taken, not only to insure the potability of the water, but also to make it conform with the Philippine Health Service standard for artesian waters; namely, not more than 500 colonies per cubic centimeter and no *B. coli* present.

In order to minimize the possibility of contaminating the water with pathogenic organisms, all necessary precautions are taken to have the uninhabited watershed, which comprises about 108 square miles (about 173 square kilometers), well guarded and to have the chlorination carefully controlled in the laboratory and at the plant. As a result, *B. coli* is seldom found in the city water supply as shown by the results of bacteriological analyses made daily of one sample of the untreated water and of two samples of the treated water from two different points.

The gas formers which appear at times in the city water and which are responsible for the positive presumptive test are as a rule not true *B. coli*, but are other members of the *coli* group which are not necessarily of faecal origin.⁴

TURBIDITY

The turbidity of the city water is determined daily and, as water of high turbidity usually contains a relatively large amount of organic matter and suspended materials that may occlude the bacteria or that may absorb chlorine before disinfection can take place, an appreciable rise in turbidity usually has to be attended by an increase in the dose of chlorine.

In this connection it is interesting to note that as far as the city water supply (which is not subjected to filtration) is concerned, the turbidity is more or less directly proportional to the amount of rainfall in the vicinity of the watershed. This relationship can be readily seen from the turbidity and rainfall diagrams given in fig. 1.

It will also be noticed on examination of fig. 2 that a marked rise in turbidity usually follows one day after a relatively heavy rainfall in the neighborhood of the watershed. The amount of rain falling in one day, therefore, may be used partly as an index of the dose of chlorine that must be added to the water the following day. A dose of chlorine given this way would be more timely than the same dose determined and added after the results of laboratory tests are obtained.

⁴ Schöbl and Ramirez, *postea*, 317.

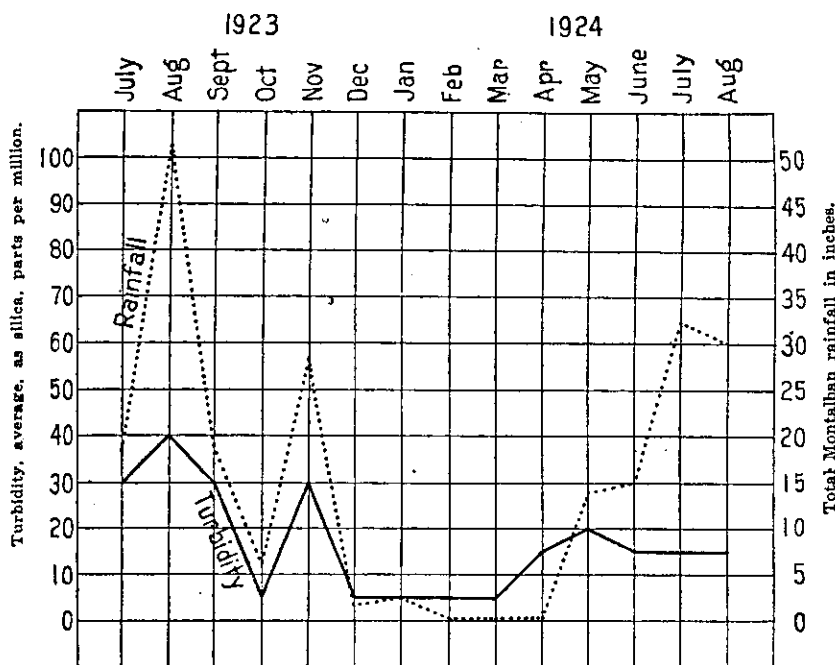


FIG. 1. Monthly variations in turbidity and rainfall.

While it is true that a high turbidity requires a higher dosage due to an increased chlorine-consuming capacity, the converse is not necessarily true. It is hard to find direct relationship between turbidity and chlorine absorption. The turbidity may remain constant for some time while the chlorine-consuming power may change. The turbidity may fluctuate, but the chlorine-consuming power may not closely follow the fluctuations, although it may tend to rise with an increase in turbidity. An examination of Table 1 will verify this statement.

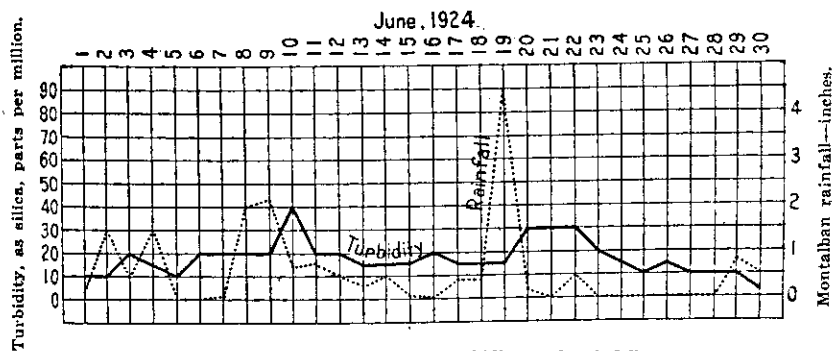


FIG. 2. Daily variations in turbidity and rainfall.

Sperry and Billings⁵ report only a general relationship between river-water turbidity and chlorine absorption, direct relationship being absent. When we consider that the composition of the materials making up the turbidity may vary and that chlorine-absorbing substances may sometimes be in solution and sometimes in suspension, it is not surprising to find a lack of direct connection between turbidity and chlorine absorption.

Some difficulty has been experienced in testing for residual chlorine with *o*-tolidine when the water is turbid. It seems that either the color of the suspended matter or the slightly opaque condition of the water interferes with the yellow color produced by the *o*-tolidine. The resulting color sometimes corresponds to a figure lower than the actual chlorine content, and sometimes is of a shade that is not comparable with the standards; *o*-tolidine is suitable for only clear or filtered waters. The cause of the interference and its remedy are being made the subject of study at present.

RESULTS OF PRESENT TREATMENT

Under the present system of chlorination and with the improved equipment, the sterilization of the Manila water supply is more effective and efficient than under the older treatment. The low colony counts, together with the almost complete absence of pathogenic organisms, make the city water safe for drinking purposes. Table 4 gives the bacterial reductions accomplished with the present treatment. Although the reductions are not as great as is desirable, they point to a decided improvement. The figures in Table 4 were obtained in the same way as were those of Table 2.

A record of the tests for residual chlorine, for turbidity, for the colony counts, and for *Bacterium coli*, together with the doses used in the present treatment, is given in Table 5. A word of explanation regarding those tests will be convenient.

The second column shows the results of tests for residual chlorine in parts per million made of water from a spigot at the Bureau of Science, where the control work is done. The tests are made at different hours of the day, the usual hours being 8 a. m., 12 a. m., 2 p. m., and 4 p. m. As previously stated, *o*-tolidine is used for the determinations. Results in terms of "positive," "nil," etc., indicate that quantitative tests

⁵ Journ. Am. Water Works Assoc. 8 (1921) 603.

could not be made, owing to interference of the turbidity or color of the water.

The turbidity is reported in parts per million of silica. The silica comparison method of the American Public Health Association is used.

The fourth column gives the number of colonies found per cubic centimeter on agar incubated at 37° C for forty-eight hours.

TABLE 4.—*Bacterial reduction with present treatment.*

| Date. | Average reduction. | |
|----------------|--------------------|-----------------------|
| | At San Juan. | At Bureau of Science. |
| 1923 | <i>Per cent.</i> | <i>Per cent.</i> |
| July..... | 76 | 80 |
| August..... | 80 | 83 |
| September..... | 84 | 87 |
| October..... | 86 | 79 |
| November..... | 80 | 83 |
| December..... | 76 | 77 |
| 1924 | | |
| January..... | 91 | 81 |
| February..... | 87 | 89 |
| March..... | 74 | 74 |
| April..... | 78 | 67 |
| May..... | 68 | 60 |
| June..... | 83 | 72 |
| July..... | 80 | 77 |
| August..... | 82 | 85 |

TABLE 5.—*Results of examination of city water and record of dosage.**

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | <i>Bacillus coli</i> test. | Chlorine dose, parts per million. |
|-----------------|---------------------------------------|-------------------------------|--------------------------------|----------------------------|-----------------------------------|
| 1923 | | | | | |
| October 1..... | | | 30 | Negative.. | |
| October 2..... | | | 2 | do..... | 0.9 |
| October 3..... | Present..... | 15 | 30 | do..... | 0.9→0.8 |
| October 4..... | do..... | 40 | 40 | do..... | 0.8 |
| October 5..... | Present; trace..... | 40 | 40 | do..... | 0.8 |
| October 6..... | Trace; present..... | 30 | 36 | do..... | 0.8 |
| October 7..... | Nil; trace; present..... | 40 | b 5,720 | do..... | 0.8 |
| October 8..... | Nil; trace; nil..... | 40 | 120 | do..... | 0.8→0.9 |
| October 9..... | | | 430 | do..... | 0.9 |
| October 10..... | 0.2; 0.06; 0.2..... | 15 | 16 | do..... | 0.9→0.8 |
| October 11..... | 0.3; 0.2; 0.2; 0.3..... | 15 | 40 | do..... | 0.8 |

* No record is given for November, 1923, because the reservoir and the chlorination plant were cleaned and repaired during that month. Although the water was chlorinated, the dosing was not very accurate.

^b There is ample reason to believe that counts like these, which are unusually high, non-persistent, and far from the average, are due to local pollution and do not represent the real quality of the water.

TABLE 5.—Results of examination of city water and record of dosage—Continued.

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | <i>Bacillus</i> coil test. | Chlorine dose, parts per million. |
|-------------|---------------------------------------|-------------------------------|--------------------------------|----------------------------|-----------------------------------|
| 1923 | | | | | |
| October 12 | 0.2; 0.3; 0.2; 0.1 | 15 | 30 | Negative | 0.8 |
| October 13 | 0.2; 0.25 | 5 | 4 | do | 0.8 |
| October 14 | Present | 5 | 12 | do | 0.8 |
| October 15 | 0.25; 0.3; 0.3 | 15 | 20 | do | 0.8→0.7 |
| October 16 | 0.2; 0.25; 0.2; 0.3 | 15 | 8 | do | 0.7 |
| October 17 | | 5 | 18 | do | 0.7 |
| October 18 | 0.2; 0.2 | 10 | 4 | do | 0.7 |
| October 19 | 0.2; 0.3 | 5 | 4 | do | 0.7 |
| October 20 | 0.2; 0.3 | 5 | 4 | do | 0.7 |
| October 21 | 0.1 | 5 | 50 | do | 0.7 |
| October 22 | 0.1 | 5 | 30 | do | 0.7 |
| October 23 | 0.2; 0.3 | 5 | 16 | do | 0.7 |
| October 24 | 0.2; 0.2; 0.2 | 5 | 100 | do | 0.7 |
| October 25 | 0.07; 0.2; 0.3 | 5 | 40 | do | 0.7 |
| October 26 | 0.2; 0.3; 0.3; 0.25; 0.3 | 5 | 90 | do | 0.7 |
| October 27 | 0.3; 0.25; 0.3 | 5 | 400 | do | 0.7 |
| October 28 | | 5 | 22,890 | do | 0.7 |
| October 29 | 0.4; 0.1; 0.15 | 5 | 28 | do | 0.7→0.6 |
| October 30 | 0.3; 0.3; 0.2; 0.3 | 10 | 12 | do | 0.6 |
| October 31 | 0.35; 0.25; 0.35; 0.3 | 10 | 8 | do | 0.6 |
| December 1 | 0.25; 0.5; 0.5; 0.5 | 10 | 1,200 | do | 0.6→0.7 |
| December 2 | | | 16 | do | 0.7 |
| December 3 | 0.3; 0.3; 0.4 | 10 | 8 | do | 0.7→0.6 |
| December 4 | 0.2; 0.3; 0.25; 0.2 | 10 | 8 | do | 0.6 |
| December 5 | 0.25; 0.3; 0.25; 0.25 | 10 | 4 | do | 0.6 |
| December 6 | 0.04; 0.04; 0.04; 0.03 | 20 | 34 | do | 0.6→0.7 |
| December 7 | 0.07; 0.08; 0.15; 0.2 | 15 | 2,540 | Positive | 0.7→0.8 |
| December 8 | 0.2; 0.25; 0.3 | 10 | 10 | Negative | 0.8 |
| December 9 | | | 2 | do | 0.8 |
| December 10 | 0.25; 0.4; 0.35; 0.35 | 5 | 8 | do | 0.8→0.7 |
| December 11 | 0.2; 0.35; 0.4 | 5 | 6 | do | 0.7→0.6 |
| December 12 | 0.2; 0.3; 0.3; 0.35 | 5 | 4 | do | 0.6 |
| December 13 | 0.2; 0.4; 0.35; 0.45 | 5 | 8 | do | 0.6 |
| December 14 | 0.2; 0.35; 0.4 | 5 | 4 | do | 0.6 |
| December 15 | 0.25; 0.3; 0.3 | 5 | 1,900 | do | 0.6 |
| December 16 | | 5 | 2 | do | 0.6 |
| December 17 | 0.25; 0.35; 0.35; 0.35 | 5 | 8 | do | 0.6 |
| December 18 | 0.2; 0.25; 0.2; 0.15 | 5 | 16 | do | 0.6 |
| December 19 | | 5 | 12 | do | 0.6 |
| December 20 | | 5 | 34 | do | 0.6 |
| December 21 | | 5 | 1,900 | do | 0.6→0.8 |
| December 22 | 0.5; 0.4; 0.4 | 5 | 2 | do | 0.8→0.6 |
| December 23 | | 5 | 15 | do | 0.6 |
| December 24 | 0.08; 0.3; 0.2; 0.4 | 5 | 2 | do | 0.6 |
| December 25 | | 5 | 2 | do | 0.6 |
| December 26 | 0.2; 0.3; 0.3; 0.3 | 5 | 12 | do | 0.6 |
| December 27 | 0.3; 0.3; 0.2; 0.2 | 5 | 0 | do | 0.6 |

^b There is ample reason to believe that counts like these, which are usually high, non-persistent, and far from the average, are due to local pollution and do not represent the real quality of the water.

TABLE 5.—Results of examination of city water and record of dosage—Continued.

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | <i>Bacillus coli</i> test. | Chlorine dose, parts per million. |
|------------------|---------------------------------------|-------------------------------|--------------------------------|----------------------------|-----------------------------------|
| 1923 | | | | | |
| December 28..... | ----- | 5 | 0 | Negative.. | 0.6 |
| December 29..... | 0.3; 0.3; 0.3..... | 5 | 10 | do..... | 0.6 |
| December 30..... | ----- | 5 | 36 | do..... | 0.6 |
| December 31..... | ----- | 5 | 2 | do..... | 0.6 |
| 1924 | | | | | |
| January 1..... | ----- | 5 | 6 | do..... | 0.6 |
| January 2..... | 0.5; 0.4; 0.3..... | 5 | 2 | do..... | 0.6 |
| January 3..... | 0.5; 0.4; 0.2; 0.2..... | 15 | 15 | do..... | 0.6 |
| January 4..... | 0.4; 0.25; 0.3; 0.3..... | 5 | 10 | do..... | 0.6 |
| January 5..... | 0.3; 0.2..... | 5 | 4 | do..... | 0.6 |
| January 6..... | 0.3; 0.3..... | 5 | 22 | do..... | 0.6 |
| January 7..... | 0.2; 0.2; 0.2; 0.3..... | 5 | 4 | do..... | 0.6 |
| January 8..... | 0.35; 0.2; 0.2; 0.2..... | 5 | 78 | do..... | 0.6 |
| January 9..... | 0.4; 0.2; 0.3; 0.35..... | 5 | 23 | do..... | 0.6 |
| January 10..... | 0.07; 0.3; 0.2; 0.3..... | 5 | 10 | do..... | 0.6 |
| January 11..... | 0.3; 0.2; 0.2; 0.3..... | 5 | 66 | do..... | 0.6 |
| January 12..... | 0.5; 0.4; 0.3..... | 5 | 6 | do..... | 0.6→0.7 |
| January 13..... | 0.25; 0.15..... | 5 | 4 | do..... | 0.7 |
| January 14..... | 0.2; 0.2; 0.2; 0.2..... | 5 | 6 | do..... | 0.7 |
| January 15..... | 0.08; 0.06; 0.04..... | 5 | 60 | do..... | 0.7→0.9 |
| January 16..... | 0.2; 0.1; 0.1; 0.15..... | 5 | 630 | do..... | 0.9 |
| January 17..... | 0.1; 0.08; 0.07; 0.1..... | 5 | 104 | do..... | 0.9→1.0 |
| January 18..... | 0.3; 0.3; 0.3; 0.2..... | 5 | 10 | do..... | 1.0 |
| January 19..... | 0.35; 0.3..... | 5 | 18 | do..... | 1.0 |
| January 20..... | ----- | 5 | 60 | do..... | 1.0 |
| January 21..... | 0.2; 0.25; 0.4; 0.4..... | 5 | 12 | do..... | 1.0 |
| January 22..... | 0.4; 0.3; 0.4; 0.5..... | 5 | 16 | do..... | 1.0→0.8 |
| January 23..... | 0.3; 0.2; 0.2; 0.3..... | 5 | 6 | do..... | 0.8 |
| January 24..... | 0.4; 0.3; 0.2; 0.3..... | 5 | 8 | do..... | 0.8 |
| January 25..... | 0.3; 0.3; 0.4..... | 5 | 630 | do..... | 0.8→0.6 |
| January 26..... | 0.2; 0.2..... | 5 | 6 | do..... | 0.6 |
| January 27..... | 0.2..... | 5 | 6 | Positive.. | 0.6 |
| January 28..... | 0.2; 0.2; 0.2; 0.2..... | 5 | 14 | Negative.. | 0.6 |
| January 29..... | 0.1; 0.2; 0.2; 0.2..... | 5 | 8 | do..... | 0.6 |
| January 30..... | 0.1; 0.2; 0.2..... | 5 | 10 | do..... | 0.6 |
| January 31..... | 0.2; 0.1; 0.1..... | 5 | 12 | do..... | 0.6→0.5 |
| February 1..... | 0.15; 0.08; 0.1; 0.15; 0.15..... | 5 | 33 | do..... | 0.5 |
| February 2..... | 0.15; 0.1; 0.15..... | 5 | 12 | do..... | 0.5 |
| February 3..... | ----- | 5 | 12 | do..... | 0.5 |
| February 4..... | 0.1; 0.08; 0.1..... | 5 | 23 | do..... | 0.5 |
| February 5..... | 0.15; 0.2; 0.1; 0.1..... | 5 | 2 | do..... | 0.5 |
| February 6..... | 0.15; 0.08; 0.1..... | 5 | 2 | do..... | 0.5 |
| February 7..... | 0.25; 0.06; 0.05; 0.05..... | 5 | 4 | do..... | 0.5 |
| February 8..... | 0.2; 0.1; 0.1; 0.08..... | 5 | 4 | do..... | 0.5 |
| February 9..... | 0.2; 0.15; 0.15..... | 5 | 0 | do..... | 0.5 |
| February 10..... | ----- | 5 | 2 | Positive.. | 0.5 |
| February 11..... | 0.08; 0.1; 0.06; 0.06..... | 5 | 10 | Negative.. | 0.5→0.6 |
| February 12..... | 0.1; 0.1; 0.1; 0.1..... | 5 | 16 | Positive.. | 0.6 |
| February 13..... | 0.15; 0.1; 0.15; 0.2..... | 5 | 4 | Negative.. | 0.6 |
| February 14..... | 0.1; 0.15; 0.15..... | 5 | 8 | do..... | 0.6 |

TABLE 5.—Results of examination of city water and record of dosage—Continued.

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | Bacillus coli test. | Chlorine dose, parts per million. |
|-------------|---------------------------------------|-------------------------------|--------------------------------|---------------------|-----------------------------------|
| 1924 | | | | | |
| February 15 | 0.2; 0.1; 0.1 | 5 | 2 | Negative | 0.6 |
| February 16 | 0.2; 0.06 | 5 | 2 | do. | 0.6 |
| February 17 | | 5 | 4 | do. | 0.6 |
| February 18 | 0.2; 0.08 | 5 | 0 | Positive | 0.6 |
| February 19 | 0.15; 0.1 | 5 | 2 | Negative | 0.6 |
| February 20 | 0.08; 0.1 | 5 | 500 | do. | 0.6 |
| February 21 | 0.1; 0.08 | 5 | 2 | do. | 0.6→0.7 |
| February 22 | 0.2 | 5 | 2 | do. | 0.7 |
| February 23 | 0.1; 0.08 | 5 | 2 | do. | 0.7 |
| February 24 | 0.1 | 5 | 2 | do. | 0.7 |
| February 25 | 0.08; 0.1; 0.08; 0.08 | 5 | 2 | do. | 0.7→0.8 |
| February 26 | 0.2; 0.1; 0.1; 0.1 | 5 | 6 | do. | 0.8 |
| February 27 | 0.1; 0.1; 0.1; 0.1 | 5 | 2 | do. | 0.8 |
| February 28 | 0.2; 0.06; 0.06; 0.04 | 5 | 2 | do. | 0.8 |
| February 29 | 0.06; 0.08; 0.1; 0.09 | 5 | 2 | do. | 0.8→0.9 |
| March 1 | 0.1; 0.08 | 5 | 16 | do. | 0.9 |
| March 2 | | 5 | 10 | do. | 0.9 |
| March 3 | 0.1; 0.1; 0.08 | 5 | 8 | do. | 0.9 |
| March 4 | 0.1; 0.1; 0.1; 0.1 | 5 | 2 | do. | 0.9 |
| March 5 | 0.09; 0.1; 0.15 | 5 | 14 | do. | 0.9→0.7 |
| March 6 | | 5 | 162 | do. | 0.7 |
| March 7 | 0.06; 0.07; 0.08; 0.1 | 5 | 2 | do. | 0.7 |
| March 8 | 0.09; 0.09 | 5 | 16 | do. | 0.7 |
| March 9 | | 5 | 4 | do. | 0.7 |
| March 10 | 0.1; 0.07; 0.07; 0.1 | 5 | 6 | do. | 0.7 |
| March 11 | 0.1; 0.07; 0.07; 0.07 | 5 | 4 | do. | 0.7 |
| March 12 | 0.07; 0.05; 0.06; 0.04 | 5 | 28 | do. | 0.7→0.8 |
| March 13 | 0.15; 0.1; 0.08; 0.1 | 5 | 8 | do. | 0.8 |
| March 14 | 0.1; 0.07; 0.1; 0.1 | 5 | 42 | do. | 0.8 |
| March 15 | 0.1; 0.07 | 5 | 140 | do. | 0.8 |
| March 16 | | 5 | 40 | do. | 0.8 |
| March 17 | 0.1; 0.1; 0.1 | 5 | 10 | do. | 0.8 |
| March 18 | 0.08; 0.08; 0.08; 0.08 | 5 | 6 | do. | 0.8 |
| March 19 | 0.1; 0.1; 0.1; 0.1 | 5 | 4 | do. | 0.8 |
| March 20 | 0.07; 0.1; 0.1; 0.1 | 5 | 8 | do. | 0.8 |
| March 21 | 0.15; 0.1; 0.07; 0.07 | 5 | 40 | do. | 0.8 |
| March 22 | 0.1; 0.1 | 5 | 6 | do. | 0.8 |
| March 23 | 0.08 | 5 | 2 | do. | 0.8 |
| March 24 | 0.09; 0.07; 0.07 | 5 | 8 | do. | 0.8 |
| March 25 | 0.1; 0.09; 0.09; 0.07 | 5 | 10 | do. | 0.8 |
| March 26 | 0.1; 0.09; 0.1; 0.09 | 5 | 8 | do. | 0.8 |
| March 27 | 0.1; 0.1; 0.09; 0.1 | 5 | 16 | do. | 0.8 |
| March 28 | | 5 | 40 | do. | 0.8 |
| March 29 | 0.15; 0.1 | 5 | 40 | do. | 0.8 |
| March 30 | | 5 | 20 | do. | 0.8 |
| March 31 | 0.05; 0.06 | 5 | 22 | do. | 0.8 |
| April 1 | 0.1; 0.09; 0.06; 0.05 | 15 | 30 | do. | 0.8 |
| April 2 | 0.5; 0.08; 0.07; 0.06; 0.04 | 15 | 2 | do. | 0.8 |
| April 3 | 0.1; 0.06; 0.04 | 10 | 36 | do. | 0.8 |

TABLE 5.—Results of examination of city water and record of dosage—Continued.

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | <i>Bacillus coli</i> test. | Chlorine dose, parts per million. |
|---------------|---------------------------------------|-------------------------------|--------------------------------|----------------------------|-----------------------------------|
| 1924 | | | | | |
| April 4..... | 0.08..... | 15 | 24 | Negative.. | 0.8 |
| April 5..... | 0.05; 0.05..... | 15 | 52 | do..... | 0.8 |
| April 6..... | 0.05; 0.05..... | 15 | 60 | do..... | 0.8 |
| April 7..... | 0.08; 0.08; 0.08..... | 15 | 23 | do..... | 0.8 |
| April 8..... | 0.08; 0.1..... | 15 | 52 | do..... | 0.8 |
| April 9..... | 0.08; 0.1..... | 10 | 56 | do..... | 0.8 |
| April 10..... | 0.07; 0.07..... | 10 | 80 | do..... | 0.8 |
| April 11..... | 0.07..... | 10 | 50 | do..... | 0.8 |
| April 12..... | 0.07; 0.07..... | 10 | 58 | do..... | 0.8 |
| April 13..... | ..... | 10 | 18 | do..... | 0.8 |
| April 14..... | 0.7; 0.09..... | 5 | 16 | do..... | 0.8 |
| April 15..... | 0.09; 0.09..... | 10 | 150 | do..... | 0.8 |
| April 16..... | 0.1; 0.1..... | 15 | 96 | do..... | 0.8 |
| April 17..... | ..... | 20 | 4 | do..... | 0.8 |
| April 18..... | ..... | 15 | 100 | do..... | 0.8 |
| April 19..... | 0.1..... | 15 | 56 | do..... | 0.8 |
| April 20..... | ..... | 15 | 18 | do..... | 0.8 |
| April 21..... | 0.9..... | 15 | 630 | do..... | 0.8 |
| April 22..... | 0.09; 0.1; 0.09; 0.1..... | 15 | 48 | do..... | 0.8 |
| April 23..... | 0.4; 0.1; 0.09..... | 15 | 24 | do..... | 0.8 |
| April 24..... | 0.2; 0.1..... | 15 | 8 | do..... | 0.8 |
| April 25..... | 0.1; 0.1; 0.09..... | 15 | 48 | do..... | 0.8 |
| April 26..... | 0.1; 0.1..... | 20 | 84 | do..... | 0.8 |
| April 27..... | ..... | 20 | 70 | do..... | 0.8 |
| April 28..... | 0.1; 0.1; 0.1..... | 20 | 80 | do..... | 0.8 |
| April 29..... | 0.15; 0.1; 0.1..... | 20 | 18 | do..... | 0.8→0.7 |
| April 30..... | 0.1; 0.1..... | 20 | 30 | do..... | 0.7 |
| May 1..... | ..... | 15 | 2 | do..... | 0.7 |
| May 2..... | ..... | 10 | 310 | do..... | 0.7 |
| May 3..... | ..... | 10 | 20 | do..... | 0.7 |
| May 4..... | ..... | 10 | 10 | do..... | 0.7 |
| May 5..... | 0.1; 0.2..... | 10 | 20 | do..... | 0.7 |
| May 6..... | 0.1; 0.1..... | 15 | 70 | do..... | 0.7 |
| May 7..... | 0.1; 0.09; 0.09..... | 15 | 74 | do..... | 0.7 |
| May 8..... | 0.1; 0.1; 0.08..... | 15 | 40 | do..... | 0.7 |
| May 9..... | 0.2; 0.1; 0.15..... | 15 | 110 | do..... | 0.7→0.6 |
| May 10..... | 0.1..... | 15 | 20 | do..... | 0.6 |
| May 11..... | ..... | 15 | 100 | do..... | 0.6 |
| May 12..... | 0.08; 0.08; 0.08..... | 15 | 50 | do..... | 0.6 |
| May 13..... | 0.09; 0.09; 0.08..... | 15 | 86 | do..... | 0.6 |
| May 14..... | 0.09; 0.09; 0.09..... | 15 | 1,900 | do..... | 0.6 |
| May 15..... | 0.07; 0.1..... | 20 | 700 | do..... | 0.6 |
| May 16..... | 0.3; 0.1..... | 20 | 51,510 | do..... | 0.6 |
| May 17..... | 0.1; 0.09..... | 20 | 260 | do..... | 0.6 |
| May 18..... | ..... | 20 | 3,495 | do..... | 0.6 |
| May 19..... | 0.1; 0.1..... | 20 | 11,440 | do..... | 0.6 |
| May 20..... | 0.1; 0.1..... | 20 | 2,540 | do..... | 0.6 |
| May 21..... | 0.1; 0.1..... | 20 | 8,585 | do..... | 0.6 |
| May 22..... | 0.1; 0.15..... | 20 | 44 | do..... | 0.6 |

TABLE 5.—Results of examination of city water and record of dosage—Continued.

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | <i>Bacillus coli</i> test. | Chlorine dose, parts per million. |
|---------|---------------------------------------|-------------------------------|--------------------------------|----------------------------|-----------------------------------|
| 1924 | | | | | |
| May 23 | 0.15; 0.2 | 20 | 66 | Negative | 0.6 |
| May 24 | 0.09; 0.1 | 20 | 6 | do. | 0.6 |
| May 25 | | 20 | 72 | do. | 0.6 |
| May 26 | 0.1; 0.09 | 15 | 190 | do. | 0.6 |
| May 27 | 0.04; 0.04 | 20 | 1,200 | do. | 0.6→0.7 |
| May 28 | 0.04; 0.04 | 30 | 5,720 | do. | 0.7→0.8 |
| May 29 | 0.01; 0.03 | 40 | 3,180 | do. | 0.8→0.9 |
| May 30 | 0.01; 0.02 | 40 | 4,350 | do. | 0.9→1.0 |
| May 31 | 0.01; nil | 40 | 2,540 | do. | |
| June 1 | | 10 | 300 | do. | 1.0 |
| June 2 | 0.03; 0.03 | 10 | 700 | do. | 1.0 |
| June 3 | 0.04; 0.04 | 20 | 1,000 | do. | 1.0 |
| June 4 | 0.05; 0.03 | 15 | 550 | do. | 1.0 |
| June 5 | 0.03; 0.03 | 10 | 3,810 | do. | 1.0 |
| June 6 | 0.03; 0.02 | 20 | 320 | do. | 1.0 |
| June 7 | 0.03; 0.03 | 20 | 426 | do. | 1.0 |
| June 8 | | | 630 | do. | 1.0 |
| June 9 | 0.04; 0.03 | 20 | 240 | do. | 1.0 |
| June 10 | Nil; nil | 40 | 200 | do. | 1.0 |
| June 11 | Nil; nil | 20 | 210 | do. | 1.0→1.2 |
| June 12 | Nil; 0.01 | 20 | 80 | do. | 1.2 |
| June 13 | Nil; 0.01 | 15 | 5,720 | do. | 1.2 |
| June 14 | 0.01; 0.01 | 15 | 160 | do. | 1.2→1.3 |
| June 15 | | | 280 | do. | 1.3 |
| June 16 | 0.03; 0.02; 0.03; 0.03 | 20 | 200 | do. | 1.3 |
| June 17 | 0.08; 0.08 | 15 | 60 | do. | 1.3→1.4 |
| June 18 | 0.1; 0.15; 0.2; 0.2 | 15 | 52 | do. | 1.4→1.2 |
| June 19 | 0.06; 0.1; 0.2; 0.2 | 15 | 44 | do. | 1.2 |
| June 20 | Nil; nil; 0.01; nil | 30 | 900 | do. | 1.2→1.3 |
| June 21 | Trace; 0.01 | 30 | 256 | do. | 1.3 |
| June 22 | | | 130 | do. | 1.3 |
| June 23 | 0.1; 0.08; 0.08; 0.08 | 20 | 600 | do. | 1.3 |
| June 24 | 0.02; 0.05; 0.05; 0.2 | 15 | 100 | do. | 1.3 |
| June 25 | 0.1; 0.2; 0.2; 0.2 | 10 | 114 | do. | 1.3→1.2 |
| June 26 | 0.1; 0.2; 0.2; 0.2 | 15 | 24 | do. | 1.2 |
| June 27 | 0.2; 0.2; 0.2 | 10 | 8 | do. | 1.2→1.1 |
| June 28 | 0.1; 0.2; 0.2 | 10 | 26 | do. | 1.1→1.0 |
| June 29 | | | 160 | do. | 1.0 |
| June 30 | 0.2; 0.2; 0.2 | 5 | 40 | do. | 1.0 |
| July 1 | 0.1; 0.1; 0.1; 0.1 | 5 | 12 | do. | 1.0 |
| July 2 | 0.15; 0.15; 0.15; 0.15 | 10 | 22 | do. | 1.0 |
| July 3 | 0.15; 0.15; 0.1; 0.1 | 5 | 18 | do. | 1.0→0.9 |
| July 4 | | | 84 | do. | 0.9 |
| July 5 | 0.04; 0.05 | 10 | 132 | do. | 0.9 |
| July 6 | | | 1,144 | do. | 0.9 |
| July 7 | 0.05; 0.06; 0.06; 0.06 | 10 | 24 | do. | 0.9 |
| July 8 | 0.04; 0.06; 0.06; 0.05 | 10 | 28 | do. | 0.9 |
| July 9 | 0.05; 0.05; 0.06; 0.07 | 10 | 40 | do. | 0.9 |
| July 10 | 0.06; 0.03 | 10 | 120 | do. | 0.9 |

TABLE 5.—Results of examination of city water and record of dosage—Continued.

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | <i>Bacillus coli</i> test. | Chlorine dose, parts per million. |
|----------------|---|-------------------------------|--------------------------------|----------------------------|-----------------------------------|
| 1924 | | | | | |
| July 11..... | 0.05; 0.06; 0.07; 0.07..... | 10 | 26 | Negative | 0.9 |
| July 12..... | 0.06; 0.06..... | 5 | 100 | do. | 0.9 |
| July 13..... | | | 106 | do. | 0.9 |
| July 14..... | 0.05; 0.05; 0.05; 0.05..... | 5 | 76 | do. | 0.9 |
| July 15..... | 0.04; 0.04; 0.04..... | 10 | 80 | do. | 0.9 |
| July 16..... | 0.01; 0.02; 0.02..... | 30 | 130 | do. | 0.9 |
| July 17..... | Nil; present; present..... | 30 | 146 | do. | 0.9→1.2 |
| July 18..... | Present; present; present; present..... | 40 | 20 | do. | 1.2 |
| July 19..... | Present; 0.15..... | 40 | 190 | do. | 1.2 |
| July 20..... | | | 30 | do. | 1.2 |
| July 21..... | 0.3; 0.3; 0.3; 0.3..... | 20 | 30 | do. | 1.2→1.0 |
| July 22..... | 0.5; 0.2; 0.1; 0.05..... | 20 | 30 | do. | 1.0→0.8 |
| July 23..... | 0.2; 0.2; 0.2; 0.2..... | 20 | 190 | do. | 0.8 |
| July 24..... | 0.15; 0.1; 0.1; 0.1..... | 20 | 100 | do. | 0.8 |
| July 25..... | 0.1; 0.07; 0.05; 0.05..... | 25 | 63 | do. | 0.8 |
| July 26..... | | 20 | 30 | do. | 0.8 |
| July 27..... | | | 50 | do. | 0.8 |
| July 28..... | 0.3; 0.3; 0.25; 0.2..... | 10 | 20 | do. | 0.8→0.7 |
| July 29..... | 0.2; 0.2; 0.15; 0.15..... | 10 | 40 | do. | 0.7→0.6 |
| July 30..... | 0.15; 0.2; 0.2; 0.2..... | 5 | 120 | do. | 0.6 |
| July 31..... | 0.2; 0.2; 0.2; 0.2..... | 10 | 10 | do. | 0.6 |
| August 1..... | 0.1; present; present..... | 20 | 2,850 | do. | 0.6→0.7 |
| August 2..... | 0.1..... | | 11,440 | do. | 0.7 |
| August 3..... | | | 48 | do. | 0.7 |
| August 4..... | 0.3; present; present; present..... | 25 | 70 | do. | 0.7→0.6 |
| August 5..... | Present; trace; nil; nil..... | 40 | 180 | do. | 0.6→0.8 |
| August 6..... | Trace; trace; present; present..... | 40 | 116 | do. | 0.8→1.0 |
| August 7..... | Present; present; present; present..... | 50 | 96 | do. | 1.0 |
| August 8..... | Present; present; present; present..... | 30 | 60 | do. | 1.0 |
| August 9..... | Present; present..... | 30 | 120 | do. | 1.0 |
| August 10..... | | | 12 | do. | 1.0 |
| August 11..... | Present; 0.4; 0.4; 0.5..... | 10 | 56 | do. | 1.0→0.8 |
| August 12..... | 0.4; 0.3; 0.2; 0.2..... | 10 | 16 | do. | 0.8→0.6 |
| August 13..... | | | 28 | do. | 0.6 |
| August 14..... | 0.2; 0.2; 0.2; 0.2..... | 5 | 10 | do. | 0.6 |
| August 15..... | 0.2; 0.2; 0.2; 0.2..... | 5 | 40 | do. | 0.6 |
| August 16..... | 0.3; 0.2..... | 5 | 26 | do. | 0.6→0.5 |
| August 17..... | | | 18 | do. | 0.5 |
| August 18..... | 0.15; 0.2; 0.2; 0.2..... | 5 | 8 | do. | 0.5 |
| August 19..... | 0.15; 0.2; 0.2; 0.2..... | 5 | 46 | do. | 0.5 |
| August 20..... | 0.15; 0.2..... | 5 | 24 | do. | 0.5 |
| August 21..... | 0.2; 0.2; 0.1..... | 5 | 28 | do. | 0.5→0.4 |
| August 22..... | 0.06; 0.03..... | 5 | 52 | do. | 0.4 |
| August 23..... | 0.06..... | 5 | 152 | do. | 0.4 |

TABLE 5.—Results of examination of city water and record of dosage—Continued.

| Date. | Residual chlorine, parts per million. | Turbidity, parts per million. | Bacteria per cubic centimeter. | <i>Bacillus coli</i> test. | Chlorine dose, parts per million. |
|-----------|---------------------------------------|-------------------------------|--------------------------------|----------------------------|-----------------------------------|
| 1924 | | | | | |
| August 24 | ----- | ----- | 180 | Negative | 0.4 |
| August 25 | Nil; trace; present | 30 | 116 | do. | 0.4→1.0 |
| August 26 | 0.3; 0.3; 0.3; 0.3 | 10 | 26 | do. | 1.0→0.7 |
| August 27 | 0.1; 0.2; 0.2; 0.2 | 10 | 5,720 | do. | 0.7 |
| August 28 | 0.2; 0.2; 0.2; 0.2 | 10 | 22 | do. | 0.7→0.6 |
| August 29 | 0.15; 0.2; 0.25 | 5 | 2 | do. | 0.5 |
| August 30 | 0.2; 0.15 | 10 | 18 | do. | 0.6→0.5 |
| August 31 | ----- | ----- | 10 | do. | 0.5 |

The fifth column records the results of examinations for *Bacillus coli* in samples of 1 and 10 cubic centimeters. The examination consists of a preliminary presumptive test showing presence or absence of gas formers in lactose broth followed by a confirmatory test for *B. coli* with eosine-methylene-blue agar. The bacteriological examinations are conducted by the biological division of the Bureau of Science. The samples are taken from a tap at that laboratory.

The last column gives the doses of chlorine in parts per million used each day. The changes in dosage are indicated by arrows.

It will be noted from Table 5 that the average colony counts for the months of May and June are comparatively high. Referring to fig. 1, it will be seen that heavy rainfall in Montalban began in May and continued for a few months. From Table 4 we find that for May, 1922, the bacterial reduction was lowest. These observations do not disclose anything new, but merely bring to mind the effect of rainfall and of the accompanying surface washings upon the bacterial content of river water. It seems that we cannot very well cope with such a situation by means of chlorination alone. Undoubtedly, filtration would be of great help.

The colony counts mentioned in the preceding paragraph are comparatively high, but not so high as to render the water unsafe, especially when the practically complete absence of *B. coli* is taken into consideration.

SUMMARY AND CONCLUSION

Chlorination of the Manila water supply began in 1914 and continued under the invariable dosage plan until the middle of 1923 when control of the treatment was introduced.

A comparison of the percentages of bacterial reduction accomplished with the former and with the present treatment shows the increased effectiveness and efficiency of the treatment under control.

The dose of chlorine is controlled by constantly adjusting and changing the quantity of hypochlorite of known strength added, in order to meet the varying demands of the water.

A heavy rainfall in the vicinity of the watershed generally occasions a marked increase in turbidity and, incidentally, in the colony counts as well. No definite relationship, however, has been found to exist between turbidity and chlorine-consuming capacity.

A record of the chemical and bacteriological tests used in the control of the chlorination for the past months is given (Table 5).

The present work was carried out under the supervision of the division of inorganic and physical chemistry of the Bureau of Science. The bacteriological examinations were conducted by the biological laboratory of the same Bureau. I wish to express my gratitude to the heads of these divisions for valuable help given me in this work.

ILLUSTRATIONS

PLATE 1

- FIG. 1. Chlorination house and laboratory, new reservoir, San Juan, Rizal Province, Luzon.
2. Portion of reservoir, San Juan, Rizal Province, Luzon.

PLATE 2

Chlorination apparatus, new reservoir, San Juan, Rizal Province, Luzon.

TEXT FIGURES

- FIG. 1. Diagram showing monthly variations in turbidity and rainfall.
2. Diagram showing daily variations in turbidity and rainfall.



Fig. 1. Chlorination house and laboratory.



Fig. 2. Portion of reservoir, San Juan.

PLATE 1.

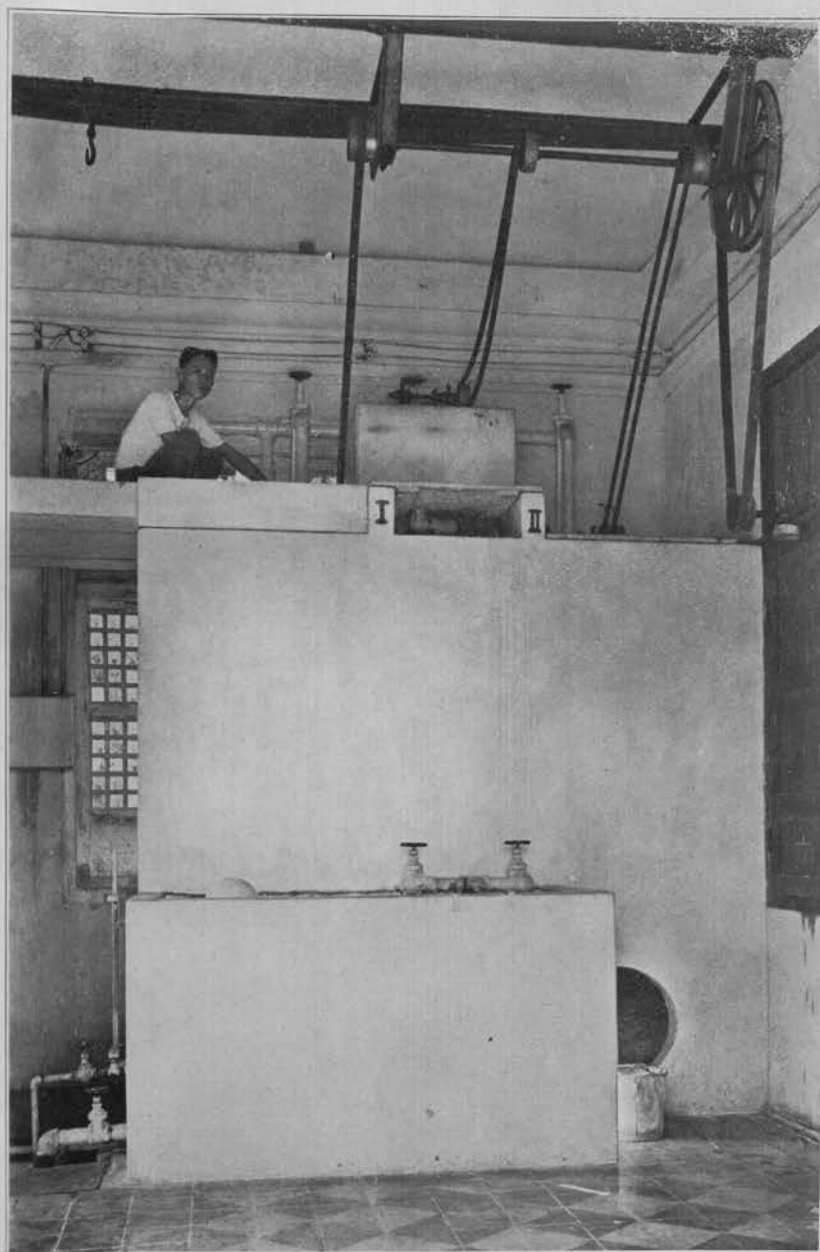


PLATE 2. CHLORINATION APPARATUS, NEW RESERVOIR, SAN JUAN, RIZAL.

THE FALLACY OF THE TEST FOR LACTOSE FERMENTERS AS AN INDICATOR OF FÆCAL POLLUTION OF WATERS

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In view of the importance attributed to the presence in water of lactose fermenters as an indication of fæcal pollution, the present study was undertaken in order to ascertain if the presence of lactose fermenters in general or some of the members in particular can be reasonably considered as an indication of contamination by human or animal excreta. The present investigation deals with two questions, namely:

Are the representatives of the *Bacillus coli* group, in the broad sense of the term, limited to human and animal excreta exclusively or predominantly so that their presence can be reasonably taken as indication of fæcal pollution, or are they so widely distributed in nature that their ubiquity makes it unreasonable to consider their presence in water as indication of fæcal contamination?

Can *B. coli* of human origin be differentiated from that of animal source?

There is more of local importance than of general interest to these investigations, for the reason that it had been recommended to close permanently certain public "artesian wells" in Manila because of the fact that lactose fermenters were found to be present in the well waters. Altogether twenty-three wells were condemned in Manila.

In view of the importance which the permanent closing of these wells would have from both an economic and a sanitary viewpoint, a committee was appointed by the Director of Health to study thoroughly the condition of the wells from the sanitary standpoint and make recommendations as to the ultimate fate of these wells.

Upon inspection by the committee it was found that there was a possibility of surface contamination of the wells through a permeable wooden plug by which the upper end of the casing

was closed. It was decided to eliminate the surface contamination first, so as to obtain information about the real condition of the well casings. The faulty wooden plugs were replaced by new disinfected ones, and they were inclosed in a concrete block. Thus the surface contamination was eliminated and the examination of the well water as it comes out on pumping was commenced. A subcommittee collected the samples of water from all of the condemned wells personally, taking three samples from each well, one at the commencement of pumping, one after thirty minutes, and one after sixty minutes pumping. Bacteriologic examination was made not later than two hours after the sample had been collected.

The striking features of the results of the examination, briefly stated, were as follows:

Rapid decrease of colonies in the well water on pumping.

Constant positive presumptive test in spite of low colony count.

Constant finding of the lactose fermenters in all the wells, though located far from each other.

The fact that the lactose fermenters were the only bacteria found, except in the case of some of the samples collected at the commencement of pumping which also contained molds, spore-bearing bacteria from the *subtilis* group, and *B. pyocyaneus*.

Due to the fact that only one kind of bacteria was encountered and on account of the sudden decrease of the number of colonies and the very low colony count in the sample collected after prolonged pumping, any underground leakage through the well casing was reasonably excluded, and it was suspected that some part of the pump harbored the bacteria found so constantly and exclusively, and that it served as a focus of contamination. Several pumps were taken apart and the parts made of organic material, such as hemp packing and leather washers, were examined and found to harbor lactose fermenters in large numbers. After proper disinfection of these parts of the pump with strong lysol the entire pump was disinfected in situ with a sufficient amount of formaline. Next day the well was pumped for at least four hours and the water was found practically sterile, although no formaldehyde could be detected in the samples of water taken for examination, according to the report of the chemist member of the subcommittee.

Furthermore, new unused packing and washers, which up to the time of bacteriologic examination had not been handled (having been delivered for examination as originally wrapped), were also found to contain lactose fermenters.

Thus, it was believed that the source of the contamination of the well water by lactose fermenters was located and the insignificance of the contamination of the well water from a sanitary standpoint demonstrated. No attempt was made to identify or to group the lactose fermenters, but they could be readily differentiated from *B. coli* on eosin-methylene-blue lactose agar plates, forming large moist cupolated colonies with more or less pronounced black center, the colony frequently assuming a pinkish tinge. True *B. coli*-like colonies were never found to develop on the plates made from the well water. In order to obtain information as to the extent of distribution of lactose fermenters in nature, samples of dust from streets and sidewalks were examined, and grass and leaves of trees and shrubs were tested, and all, without exception, were found to harbor lactose fermenters.

In the following paragraphs, the results of tests on carbohydrate media performed with some of the lactose fermenters¹ collected from various plants in and around Manila are given.

Twenty strains of motile Gram-negative lactose fermenters were tested in various carbohydrate litmus agar media. The strains were isolated from the leaves of eighteen different plants, trees, bushes, and vegetables, both during the dry season and after a heavy rain. The collection includes samples of leaves from plants close to and far from human habitations.

All of the strains of these lactose fermenters fermented (acid and gas) besides lactose also glucose, levulose, mannite, rhamnose, galactose, maltose, xylose, arabinose, and raffinose. None of them in any way attacked inulin, and there was no gas production in amygdaline.

In saccharose 19 of the 20 produced acid and gas and only 1 of the 20 lactose fermenters did not attack saccharose.

In glycerine 10 out of 20 strains produced gas.

In salicine 19 out of 20 strains gave acid and gas and only 1 was negative.

In dulcete 9 out of 20 gave acid and gas.

In dextrin 9 out of 20 gave acid and gas; the rest were negative.

In sorbite 18 out of 20 gave acid and gas and 2 were negative.

In adonite 9 out of 20 gave acid and gas; the rest were negative.

¹ We received this collection from Dr. G. R. Lacy, of the International Health Board.

The second part of the investigation answers the question: Can *B. coli* of human fæces be differentiated from *B. coli* isolated from fæces of large and small animals living on land or in water?

COLLECTION OF SPECIMENS

Fresh stools from various large animals, including man, were collected in sterile glass receptacles. Specimens from fishes were obtained in the following way: The fish was placed for several minutes in a Petri dish containing a 2 per cent lysol solution; then it was washed three or four times in sterile water, to remove the lysol, and with sterile instruments the abdomen was opened. The intestine was cut out and the contents were inoculated in a lactose broth fermentation tube. From the last washing water, 0.1 cubic centimeter was taken up with a sterile pipette and planted in a fermentation tube so that no lactose fermenters might be transferred from the surface of the animal. The same procedure was followed with the water-living small animals listed below.

The frog's abdomen was disinfected with lysol solution, then opened with sterile scissors, the intestine was cut out, and the contents planted in a fermentation tube.

The water from the Bureau of Science pond, from which the fishes and most of the insects were collected, was collected directly from the pond in a sterile bottle.

Cultures from water insects belonging to Hemiptera and from a shrimp gave slow gas formation in lactose broth, but a negative reaction in lactose and glucose agar in twenty-four hours. Diptera and Coleoptera collected at the pond gave no gas in lactose broth.

ANIMALS UTILIZED IN THE EXPERIMENT

Mammals: Horse, carabao, goat, sheep, rabbit, guinea pig, white mouse, white rat.

Birds: Pet bird, rooster, owl.

Fishes: Mosquito fish.

Amphibia: Frog.

Water insects: Hemiptera, Coleoptera, Diptera.

PROCEDURE OF ISOLATION

Each specimen was inoculated into a lactose broth fermentation tube and incubated forty-eight hours; when gas was present, three dilutions of 1 : 5, 1 : 25, and 1 : 125 were made of the culture in sterile water and one loop of each dilution was

inoculated on a Teague's (methylene-blue-eosin lactose agar) plate. The plates were incubated for twenty-four hours. From each of these plates two black colonies, resembling *B. coli* colonies, were picked out and inoculated in glucose litmus agar, stab and slant, to note the production of gas and acid.

The various carbohydrate media used were in the form of litmus agar; they were melted and slanted (low slant), and then inoculated by stab and streak. Carbohydrates were added to litmus agar in 1 per cent concentration.

Twenty-four-hour-old cultures in acid agar and bouillon were used to determine the Gram staining and motility.

The Voges-Proskauer reaction was made as follows: Tubes containing 2 per cent glucose Dunham peptone solution were inoculated and incubated for three days; then 2 cubic centimeters of concentrated caustic potash solution were added to each tube and the whole exposed to light and air for twenty-four hours before the reaction was read.²

The lead acetate test was as follows: Ordinary broth tubes were inoculated and a lead acetate paper placed at the mouth of the tube; they were then incubated twenty-four hours and the reaction read.

RÉSUMÉ OF COMPARATIVE BIOLOGICAL TEST OF LACTOSE FERMENTERS ISOLATED FROM VARIOUS ANIMALS, INCLUDING MAN

1. All strains were motile and Gram-negative.
2. All strains blackened the lead acetate paper in twenty-four hours.
3. All strains acidified and coagulated milk (canned milk) in from three to seven days.
4. All strains gave gas in lactose broth.
5. All strains gave acid and gas in the following carbohydrates: Glucose, lactose, dulcitol, maltose, mannitol, galactose, xylose, arabinose, levulose, rhamnose, sorbitol, and raffinose.
6. All strains were negative (no acid nor gas) in amygdaline and adonite.
7. Voges-Proskauer reaction, all strains were negative.
8. All strains produced acid and gas in saccharose except owl 2, white mouse 1 and 2, and rooster 2.
9. All strains gave acid in dextrin, except carabao 1 and 2 and frog 2, which gave acid and gas; and guinea pig 2, white

²Stitt, E. R., Practical Bacteriology, Blood Work, Parasitology. 7th ed. (1923) 36.

mouse 1, white rat 1 and 2, mosquito fish 2, owl 1 and 2, pet bird 1, and human 2, which gave no acid or gas.

10. All strains were negative in inosite, except mosquito fish 1 and 2, owl 1, and carabao 1 and 2, which gave acid.

11. All strains were negative in inulin, except frog 1, which gave acid.

12. All strains were negative in salicin, except goat 1, which gave acid; and guinea pig 1, mosquito fish 1 and 2, human 1 and 2, horse 2, goat 2, sheep 1 and 2, and carabao 1 and 2, which gave acid and gas.

13. In 5 per cent glycerine bouillon all strains were negative in twenty-four hours. In forty-eight hours, no strains gave gas, except owl 1 and 2 and bird 1 and 2. In seventy-two hours, all strains gave gas, except mosquito fish 1 and 2, rooster 2, human 2, horse 2, and carabao 1.

Strains from the Bureau of Science pond water gave the same reaction as the other strains, with the following differences:

Slight acidity in amygdaline, acid and gas in adonite and inosite. Discoloration of litmus in inulin, gas more than 5 per cent in twenty-four hours in 5 per cent glycerine bouillon.

Differences were encountered in the following carbohydrates:

Dextrin.—One human strain was negative, as were also strains from guinea pig, white mouse, white rat, fish, owl, and pet bird. Another human strain produced acid in dextrin, as did also the strains from rabbit, guinea pig, white mouse, fish, pet bird, rooster, horse, goat, sheep, carabao, and frog.

Inosite.—Both human strains were negative in inosite, as were also strains from rabbit, guinea pig, white mouse, white rat, owl, pet bird, rooster, horse, goat, sheep, and frog. One strain from fish, one from owl, and one from carabao produced acid, but no gas.

Inulin.—With the exception of one strain from frog, all strains, including human, were negative.

Salicin.—Both human strains gave acid and gas, as did also the strains from guinea pig, fish, horse, goat, sheep, and carabao.

In 5 per cent glycerine broth.—One human strain produced no gas, but strains from fish, rooster, horse, and carabao behaved the same way; another human strain gave gas in 5 per cent glycerine, as did also the strains from rabbit, guinea pig, white mouse, white rat, owl, pet bird, rooster, horse, goat, sheep, and frog.

Analyzing the results we find that there is no single carbohydrate, nor any group of them, which would enable us to

differentiate lactose fermenters giving a *B. coli*-like colony of human origin from those of animal origin. On the other hand, there is a distinct difference between all of the faecal strains and the strain isolated from the experimental fish pond.

The water lactose fermenter differed from all of the animal strains in that it fermented glycerine within twenty-four hours, fermented adonite and inosite, and acidified amygdaline.

It can be seen that both human strains gave acid and gas in salicin, while some of the lactose fermenters of animal origin did not attack it. It was therefore considered necessary to test a series of lactose fermenters of human origin as to their behavior to salicin.

Of forty strains of lactose fermenters isolated from forty samples of human faeces, 10 per cent gave acid and gas in salicin in twenty-four hours, 20 per cent after forty-eight hours, and 22 per cent after seventy-two hours incubation, while 48 per cent were negative.

AGGLUTINATION TEST OF LACTOSE FERMENTERS OF HUMAN, ANIMAL, AND VEGETABLE ORIGIN WITH SERUM OBTAINED FROM RABBITS IMMUNIZED WITH HUMAN STRAIN OF *B. COLI*

Two rabbits were injected with gradually increasing doses of human *B. coli* (No. 1) emulsion in salt solution, previously killed by heat at 60° C. for one hour. Injections were made subcutaneously in the abdominal region, and were given every five days. The doses were: 0.1, 0.5, 1, 2 (loop) and 0.01, 0.1, 0.2, 0.5, 0.8, 1 (slant), emulsified in 1 or 2 cubic centimeters of salt solution.

Seven days after the last injection of 1 slant, 10 cubic centimeters of blood were withdrawn by heart puncture and the blood was placed in the incubator for a half hour and in the ice chest overnight and then centrifuged for ten minutes to separate the serum, which was used to make a macroscopic agglutination test with a culture of its homologous human *B. coli* (No. 1).

About 15 cubic centimeters of salt solution were added to one slant of a twenty-four-hour-old culture in agar of the corresponding *B. coli* and the growth was emulsified and placed in a sterile tube. In a series of twelve tubes, 1 cubic centimeter of the immune serum was placed, diluted in salt solution at 1 : 2, 1 : 4, 1 : 8, 1 : 16, 1 : 32, 1 : 64, 1 : 128, 1 : 256, 1 : 512, 1 : 1024, 1 : 2048, and 1 : 4096. To each tube 1 cubic centimeter of the *B. coli* emulsion was added. In an extra tube 1

cubic centimeter of salt solution plus 1 cubic centimeter of emulsion were placed as control. The tubes were incubated for two hours at 37° C. and for twenty-four hours at room temperature, in a dark place. The reading gave a positive agglutination up to the 1 : 64 dilution of the serum.

A microscopic agglutination test was made with this immune serum and a series of 40 strains of human *B. coli*, 14 animal strains, 27 strains of plant origin, and cultures of typhoid (paratyphoid "A" and "B") as controls. Twenty-four-hour-old broth cultures were used and agglutination made in 1 : 1 concentration; the reaction was read after the culture had been allowed to stand a half hour. The results were as follows: Of the 40 human strains, 33 gave complete agglutination, 2 were incomplete, and 5 negative; of the 14 animal strains, 13 were complete and 1 negative; of the 27 plant strains, 20 gave complete agglutination, 6 incomplete, and 1 negative. The typhoid and paratyphoid "A" cultures gave a slight agglutination and the paratyphoid "B" was negative.

The fallacy of the test for lactose fermenters as an indication of faecal pollution is evident from the following conclusions:

1. Even though lactose fermenters others than true *B. coli* are frequently present in human and animal faeces, due to their wide distribution in nature and their presence in places where faecal contamination is excluded, these bacteria as a group cannot be considered as an indication of faecal contamination.

2. On the other hand, we are justified in considering true *B. coli* as an indicator of faecal pollution, owing to its relatively limited distribution outside of the human and the animal body.

3. True *B. coli* can be fairly readily differentiated from the other members of the *coli* group by the type of its colony on eosin-methylene-blue lactose agar plate.

4. Comparative tests of *B. coli* strains failed to yield any criterion for the differentiation of *B. coli* of human origin from *B. coli* of animal origin.

5. Under natural conditions the pollution of water by *B. coli* originating from the faeces of water-living animals such as fishes, frogs, and insects is not likely.

EFFECTS OF CASTRATION ON IMMATURE GUINEA PIGS¹

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FOUR TEXT FIGURES

INTRODUCTION

The experiment here reported was undertaken with the primary object of getting further information concerning the influence of castration on mammals, particularly with reference to growth in body weight, length, height, and circumference. While the number of animals employed in this study may not be sufficient from which to draw a definite conclusion, I believe the data here reported will prove of considerable value for further investigations along this line, not only with laboratory animals, but also with large domestic animals.

A systematic study of the effects of castration on mammals would lead to results of biological interest and might prove of economic importance also, in as much as castration of work animals is objected to by many people. Some entertain the idea that, if the animal is castrated before it has reached its full development, it will not acquire the size, conformation, and other characteristics that it should possess on reaching maturity; others are of the opinion that castration, whether performed before or after the age of maturity, decreases to some extent the physical strength and resistance of the animals. These beliefs, which have been handed down from father to son for generations, unquestionably have affected the live stock industry in the Philippines. The inferiority of our present types of animals can be attributed, in part at least, to the failure of our stock owners to improve the breeds by rendering the undesirable male animals incapable of procreation. No experimental evidence has been advanced as to the correctness of this opinion, so far as I know. Available records show that there has been no systematic study on the effects of castration

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on large domestic animals; that castration has been performed only for economic purposes.

SURVEY OF THE LITERATURE

Shattock and Seligmann,(18) in their experiments on young and immature common fowls and on the Herdwick breed of sheep, found that when the vasa deferentia were ligated the secondary sexual characteristics of the male bird acquired their full size, and that the sheep acquired horns and full-sized testicles comparable to those of the normal male. On the other hand, the results of a number of experiments and investigations by other authorities have demonstrated conclusively that when the sex glands are completely removed the secondary sexual characteristics undergo modification in their development in birds and in some mammals at least. The results of all experiments and investigations on this subject indicate clearly that the development of the sexual characteristics, especially the secondary ones, is controlled by some kind of internal secretion of the sexual glands which, according to many investigators, in the male animals is elaborated by the so-called interstitial cells of Leydig. The changes subsequent to the complete removal of the testicles, however, are much more conspicuous in birds than in mammals, and they are very well portrayed in the paper of Crew(2) on the effects of castration in fowls, in which he states, in part:

Castration of the male before puberty—at the age of two to three months—results in a markedly poor development of the comb, wattles and ear appendages, remaining small, pallid and almost bloodless. The sex-instinct is not exhibited, and the capon is gentle, slow, quiet, peaceful and reserved. It does not interfere with hens and is not molested by cocks. It sometimes exhibits the brooding habit. The plumage and spurs are not affected by the operation save that the plumage is rather fuller and the feather rather longer as a consequence.

Castration after puberty is immediately followed by suppression of sex-instinct, and the comb, wattles and ear appendages in the course of a few weeks lose all their vascularity, becoming bloodless and steadily diminishing in size. The plumage is not affected and the spurs continue to grow at the normal rate of two millimeters per month. Molting does not modify the type of plumage.

According to Pirsche(15) the body growth in chickens is accelerated after castration.

Of the available literature on castration of mammals the work of Fichera,(5) Marrassini,(11) and Marrassini and Luciani(12) deals primarily with the changes occurring in other

ductless glands after the removal of the male reproductive glands. Marshal(13) in his experiment on sheep concludes that—

* * * the development of horns in the males of a breed of sheep in which well marked secondary sexual differentiation occurs (as manifested especially by presence or absence of horns) depends upon a stimulus arising in the testes, and this stimulus is essential not merely for the initiation of the horn growth but for its continuance, the horns ceasing to grow whenever the testes are removed.

Poncet(16) made a study of the influence of castration on the development of the skeleton in rabbits; he also records(17) some observations on the effects of the operation upon the skeleton of dogs. In all his experiments he observed that the limb bones become longer than normal after castration. So far as I know, Stotsenberg(19) and Hatai(6) are the only investigators that have carried out thorough and systematic studies on the effects of castration on the body growth in mammals, using white rats as their experimental animals. Launois and Roy(10) record some observations on the influence of castration on the body growth in guinea pigs. The literature on castration in human beings has been thoroughly reviewed by Stotsenberg.(19)

MATERIALS AND METHODS

For this experiment sixty-four guinea pigs representing twenty-nine litters were used; thirty-five of the pigs constituted the test animals, and the remaining twenty-nine the controls. In all cases both the castrated animal and its control were taken from the same litter. This precaution was observed in order to avoid or at least to minimize the variability of characters in different litters for, according to Jackson,(8) in white rats the variability is greater when individuals of different litters are compared. All the animals used in this experiment were raised by me and were under my direct supervision; they were so kept that frequent daily observations were made possible.

Although the animals were kept in a room having a temperature ranging from 22° to 28° C., which is very much higher than the temperature (60° to 70° F.) that Draper(4) found most suitable for guinea pigs, yet no inconvenience or undesirable effects on the animals was noted. They were fed on oats and young grass; plenty of fresh water was given to them every day, though they seemed to be able to get along without it when given a liberal supply of green stuff.

The young of the selected litters were weighed, measured, and numbered soon after the hair had dried; animals born at night were weighed, measured, and numbered on the following morning. The subsequent weights and measurements of the individual animals were taken at regular intervals of one, two, four, and eight weeks. In all instances both the castrate and its control were weighed and measured on the same day and during the same hour. It may be mentioned in this connection that, of the methods tried for numbering guinea pigs, the artificial notches and clefts made on the pinna or auricula of the external ear proved to be the most satisfactory.

Most of the animals intended for use as tests were castrated at the age of six weeks, at which time they and their respective controls were separated from their mothers. In litters having more than two males, only one was left as control. It has been my experience that in the majority of the cases, the removal of the testicles by scrotal incision at an age younger than six weeks is almost impossible, because prior to that age the glands are still held firmly within the abdominal cavity. Even at the age of six weeks the testes have not descended into the scrotal sacs, but in spite of this the operation is quite safe and practicable, as by this time, owing to the comparatively wide inguinal rings and canals of these animals, the sex glands can be gently squeezed into the scrotal sacs where they can be retained for further manipulation by exerting pressure against the region of the pubic brim.

Before the operation the hair in and around the scrotum was clipped and the area thoroughly washed and disinfected. Then with ether the animal was put under general anæsthesia. With the testes well retained within the scrotal sacs by means of the pressure exerted by the index finger of the operator's left hand against the brim of the pubis, a longitudinal incision at the most prominent point of each scrotal sac was made, and then each testis, together with its corresponding epididymis, was removed by torsion. The wounds were painted with a little tincture of iodine, and the animal was isolated for three days. This isolation was for the purpose of giving the animal the least possible disturbance so as to prevent hæmorrhage and to allow the wounds to heal as soon as possible. The isolation was found to be absolutely essential, otherwise the animals that had been operated upon were molested by other guinea pigs, due probably to the odor of the anæsthetic. It may be mentioned here that in the first three cases, when this precaution was not taken,

the scrotal wounds were licked by other animals to the extent that a loop of the intestine was caused to protrude through one of the incisions. After three days' isolation the castrated animal and its control were placed in the same run or inclosure where they both received similar treatment and care.

RESULTS OF THE EXPERIMENT

The changes in growth of the different parts of the body of castrated guinea pigs are so limited and harmonious that there is no apparent modification of the general body conformation as a consequence of the operation. It may be mentioned in this connection, however, that in about 40 per cent of the cases the hair appeared somewhat fuller and longer than that of the control. In general most of the secondary sexual characteristics remained rather undeveloped, and the general disposition of the castrated animals was very markedly changed.

For the sake of economy in space the records of the actual weights and measurements of each individual animal are not included in this paper; only the average weights and measurements of the castrated animals and their respective controls at different ages are given, in Tables 1, 3, 4, and 5, from which were plotted the graphs in figs. 1, 2, 3, and 4.

To test the question as to whether the lengths and weights of the long bones of the limbs are affected by castration, as is claimed by the majority of the previous investigators consulted, the actual measurements and weights of the left humerus, radius, femur, and tibia of each individual animal of the same twenty litters were carefully and accurately taken; the data obtained thereby are reported in Tables 8 and 9. In Table 6 are given the average weights and average percentages of the individual organs of the same animals.

The details of the results of this experiment, based upon the data given in the different tables and figures referred to above, will be taken up in the discussion of the individual topics.

DISCUSSION OF RESULTS

EXTERNAL APPEARANCE, GENERAL DISPOSITION, AND SECONDARY SEXUAL ORGANS

My clinical observation has been that castration, when performed on young and immature carabaos, modifies very markedly the development of the neck; it is lighter in weight and rather slender, instead of becoming broad, massive, and heavy as in the uncastrated animal. This is the reason, many carabao owners say, why they object to having their animals

castrated before they have become fully grown; they desire to have the neck developed with the natural qualities so as to get the best fitting for the yoke and, according to some, the proper strength. In horses it is the observation of Hayes(7) that geldings have comparatively lighter necks and, owing to this, as in the case of mares, the union of the neck with the head and trunk is better marked than in those that are entire. Practical stockmen claim that castration is followed by the development of more refined and graceful head and legs in horses. The above observations and assertions, however, do not apply to guinea pigs; for, so far as I was able to observe, the head, neck, and body, as well as the legs of the castrated animals presented no obvious modification.

In the light of the present findings based upon the data which will be alluded to later, it seems that the general characteristic body conformation of these animals is not appreciably altered by castration; in other words, the normal relation between the different parts remains apparently unaffected by the operation. The exceedingly enlarged paws observed by Launois and Roy(10) in their castrated guinea pigs were not noted in the castrated animals in this experiment. The development of somewhat fuller and longer hair in about 40 per cent of the castrated guinea pigs is not considered here as incident to the operation, although this finding coincides with the observation of Crew(2) in the fowl, that castration is followed by the development of rather fuller plumage and longer feathers.

The general disposition of the castrated guinea pigs was very much changed. They assumed something of the temperament of the female; that fighting spirit, which is characteristic of the full male animal and which is especially manifested in the presence of strange females, disappeared almost entirely in the castrated animals. In only a very few instances the castrates were noted to have provoked fighting; they became nonaggressive and if they fought at all it was only for a short time. The impelling impulses for sexual intercourse were mostly, if not wholly, done away with by the operation. A very few of the castrated animals were noted to have retained some symptoms of sexual desire, which consist, when exhibited, in the emission of the peculiar and characteristic sound (*krok-krok-krr-rr-rr-krok-krok-rr-rr*) of the male animals in the presence of the females and the smelling of the vulva. In no instance were the castrated animals seen to mount other animals for the purpose of sexual intercourse. On the contrary, many times

they were mistaken for females by their controls, which mounted and interfered with them very frequently. Examination of the penis of those castrated animals that still showed some sexual instinct proved that no erection of the organ occurred at the time of the exhibition of sexual symptoms. On the whole, most of the above findings agree with my personal observation and with those of Dollar,⁽³⁾ Merillat,⁽¹⁴⁾ and Thompson⁽²⁰⁾ on large domestic animals.

Of the secondary sexual organs only the scrotum was observed to be markedly affected by castration; it remained absolutely undeveloped. Contrary to the finding of Launois and Roy⁽¹⁰⁾ that the penis of their castrated guinea pigs remained undeveloped, it was observed in this experiment that the penis of the castrated animal appeared only slightly smaller than that of the control. This finding indicates that castration does not interfere with the growth and development of the penis, but, probably because of the functional disturbance in this organ, the natural size that it should possess is not acquired. The prepuce appeared somewhat tight. The teats or nipples were somewhat smaller than those of the controls; the base of each mammary gland, however, felt much more extensive and somewhat firmer in consistency than that of the controls. Dissection of the glands proved that this condition was due to the presence of a rather large and well-organized lobe of adipose tissue in the glands themselves and in the subcutaneous tissue extending from the base of each gland to the inguinal region.

THE GROWTH IN BODY WEIGHT

Whether the removal of the testes from the body of young mammals is followed by an acceleration of growth in body weight is still an open question. The results of the experiments with common fowls seem to demonstrate conclusively that there is an acceleration in growth in body weight after castration. In white rats and guinea pigs, on the other hand, the results of the previous experiments are so contradictory that it is not possible to interpret the effect of the operation on the growth in body weight in these animals in a satisfactory manner. Experimenting on three guinea pigs from the same litter, two castrated and one control, for a period of eight months, or thirty-two weeks, Launois and Roy⁽¹⁰⁾ found that in one case the castrated animal was 150 grams heavier than the control at the end of four months, and another was 30 grams heavier than the control after the same period. They fur-

ther observed that for the next four months the weights of both the castrated and the control animals did not alter materially. In white rats, on the contrary, the finding of Stotsenberg, (19) which was fully supported by that of Hatai, (6) was that the growth in body weight is not influenced at all by castration.

TABLE 1.—Average weights of the castrated and control guinea pigs at different ages.

| Age. | Castrated cases. | Weight. | Excess in favor of— | | Weight. | Control cases. |
|----------|------------------|---------|---------------------|----------|---------|----------------|
| | | | Castrated. | Control. | | |
| Weeks. | | g. | g. | g. | g. | |
| At birth | 35 | 78.9 | | 4.7 | 83.6 | 29 |
| 4 | 35 | 198.7 | | 4.9 | 203.6 | 29 |
| 8 | 35 | 298.4 | | 2.8 | 301.2 | 29 |
| 12 | 32 | 407.5 | | 3.3 | 410.8 | 26 |
| 16 | 32 | 499.4 | 13.0 | | 486.4 | 26 |
| 20 | 28 | 571.5 | | 12.4 | 583.9 | 23 |
| 24 | 26 | 623.1 | 10.5 | | 612.6 | 21 |
| 28 | 25 | 672.6 | 15.9 | | 656.7 | 20 |
| 32 | 24 | 753.2 | 50.2 | | 703.0 | 19 |
| 36 | 23 | 767.5 | 25.3 | | 742.0 | 18 |
| 40 | 23 | 789.2 | 20.9 | | 768.3 | 18 |
| 44 | 18 | 803.7 | 19.0 | | 784.7 | 14 |
| 48 | 15 | 810.4 | 14.3 | | 796.1 | 11 |
| 52 | 12 | 826.7 | 18.7 | | 802.0 | 8 |
| 56 | 5 | 810.3 | 15.1 | | 795.2 | 4 |

By referring to Table 1 it will be noted that the average weight at birth of the castrated animals was 78.9 grams, in contrast with 83.6 grams for the controls, and that the controls continued to lead in weight up to the age of twelve weeks, or about six weeks after the test animals were operated upon. At the sixteenth week, however, the castrates surpassed the controls, but at the twentieth week the controls attained almost the same weight. This condition evidently shows that there was, from the age of twelve to twenty weeks, a rather irregular increase in weight in both the castrated and the control animals. This irregularity may have been brought about by merely incidental influences.

Another thing that will be noticed from Table 1 is that the average weights of the castrated animals, starting from the age of twenty-four weeks, are always more than those of the controls, the maximum and minimum excesses being 50.5 and 10.5 grams, respectively. By taking the average of the excesses from the age of twenty-four to fifty-six weeks, it will be found

that the castrates are on an average 23.7 grams heavier than the controls at the end of every four-week interval.

In fig. 1 are shown the growth curves in body weight of the castrated and the control animals as plotted from the data in Table 1. It will be noted from this figure that, up to the age of twelve weeks, the curves run almost parallel, but between

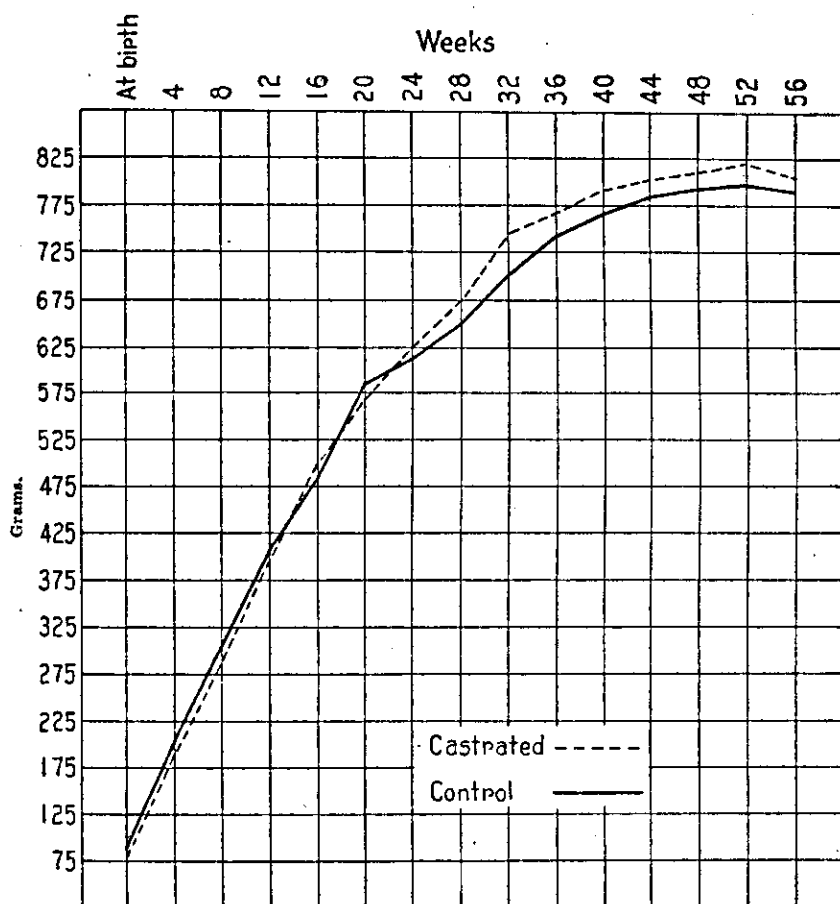


FIG. 1. Showing the curves of growth in body weight of the castrates and the controls as plotted from data in Table 1.

this age and the age of twenty-four weeks they intersect. Although the curve for the castrated animals begins to part company with that of the controls at the twenty-fourth week, yet it will be noted that from this time on its course is fairly regular in character and does not materially differ from that of the controls.

The foregoing data, together with the nature of the curves, indicate that castration in young and immature guinea pigs does

accelerate to a limited extent the growth of the body in weight. The acceleration, however, does not immediately follow the operation, but begins to be manifest about the sixteenth week after the operation, or in other words at about the age of twenty-two weeks. According to Lantz, (9) the age of maturity in guinea pigs is about four or five months. If this age of maturity is applicable in the present series, it seems that the acceleration of growth in body weight as a consequence of castration commences only after the age of maturity has been reached. Furthermore, the acceleration is fairly regular in nature and so moderate that the growth curve of the castrates does not depart markedly from the general course of the growth curve characteristic for the full animals.

THE GROWTH IN BODY LENGTH

In the works consulted on the effects of castration in guinea pigs and other mammals, no mention is made as to whether growth in body length is affected or not by the complete removal of the testes. It may be mentioned here, however, that in white rats, Hatai (6) observed that the normal relation between the body weight and the body length characteristic for his series remained unaltered in castrated animals. He further observed that the growth in body weight in these animals (white rats) is not modified by castration. It appears from this finding that Hatai noted no alteration at all of the growth in body length.

In the present investigation the term "body length" signifies the distance from the base of the head to the level of the joint formed by the second and third coccygeal vertebræ, the measurement being taken with the animal fully extended by an assistant. In order to find out the possible errors that might have been brought about by this method of taking the measurement, the actual lengths of the vertebral columns of twenty-five castrated and twenty control animals, representing twenty litters, were accurately determined after they had been sacrificed and their vertebral columns dissected and exposed. The data obtained are given in Table 2; they represent the length of the vertebral columns measured from the center of the nuchal or occipital surface of the skull, midway between the nuchal crest and the foramen magnum, to the articulation formed by the second and third coccygeal vertebræ. In case of more than one castrate in a litter only the average length is given in the table. Actual

measurement of the vertebral columns proved that the method employed here in taking the body length is accurate enough; the observed average body length of animals from twenty-four to fifty-six weeks old is 209 millimeters for the castrates and 207 for the controls, as compared with 210 and 206, average vertebral lengths for the castrates and controls, respectively. It will be noted from Table 2 that the vertebral columns of the castrated animals in 75 per cent of the litters are slightly longer than those of the controls. Taking the average length of the vertebral columns as the basis, it is found that the percentage of excess in favor of the castrated animals is 1.9.

TABLE 2.—Actual lengths of the vertebral columns of the castrated and control guinea pigs and the percentages of excess.

| Litter. | Castrated. | Excess in favor of-- | | | | Control. |
|--------------|------------|----------------------|----------|------------|-----------|----------|
| | | Castrated. | Control. | Castrated. | Control. | |
| | mm. | mm. | mm. | Per cent. | Per cent. | mm. |
| 1..... | 210 | 5 | ----- | 2.50 | ----- | 205 |
| 2..... | 206 | 1 | ----- | 0.47 | ----- | 205 |
| 3..... | 225 | 8 | ----- | 3.67 | ----- | 217 |
| 4..... | 205 | ----- | ----- | ----- | ----- | 205 |
| 5..... | 209 | 9 | ----- | 4.50 | ----- | 200 |
| 6..... | 216 | 8 | ----- | 3.84 | ----- | 208 |
| 7..... | 203 | 3 | ----- | 1.50 | ----- | 200 |
| 8..... | 217 | 7 | ----- | 3.33 | ----- | 210 |
| 9..... | 210 | 5 | ----- | 2.50 | ----- | 205 |
| 10..... | 205 | 2 | ----- | 0.98 | ----- | 203 |
| 11..... | 210 | ----- | 5 | ----- | 2.47 | 215 |
| 12..... | 200 | ----- | ----- | ----- | ----- | 200 |
| 13..... | 220 | 8 | ----- | 3.77 | ----- | 212 |
| 14..... | 215 | 10 | ----- | 4.92 | ----- | 205 |
| 15..... | 210 | 10 | ----- | 5.00 | ----- | 200 |
| 16..... | 205 | ----- | 5 | ----- | 2.44 | 210 |
| 17..... | 215 | 15 | ----- | 7.50 | ----- | 200 |
| 18..... | 208 | ----- | 7 | ----- | 3.36 | 215 |
| 19..... | 205 | 5 | ----- | 2.50 | ----- | 200 |
| 20..... | 215 | 5 | ----- | 2.38 | ----- | 210 |
| Average..... | 210 | 4 | ----- | 1.94 | ----- | 206 |

By comparing the observed average body lengths of the castrates and their controls at different ages, as given in Table 3, it will be noted that in the majority of the cases the body lengths of the castrated animals are slightly greater than those of their corresponding controls. The post-operative excess in favor of the castrates begins at the age of twelve weeks. The similarity of the post-operative lengths of the castrates and their controls

at the age of eight weeks seems to indicate that the operation does not produce immediate constitutional disturbances severe enough to retard or otherwise affect the growth in body length.

TABLE 3.—Average body lengths of the castrated and control guinea pigs at different ages.

| Age. | Castrated cases. | Length. | Excess in favor of— | | Length. | Control cases. |
|---------------|------------------|---------|---------------------|----------|---------|----------------|
| | | | Castrated. | Control. | | |
| Weeks. | | mm. | mm. | mm. | mm. | |
| At birth..... | 35 | 96 | | | 96 | 29 |
| 4..... | 35 | 137 | 2 | | 135 | 29 |
| 8..... | 35 | 160 | | | 160 | 29 |
| 12..... | 32 | 181 | 2 | | 179 | 26 |
| 16..... | 32 | 194 | 2 | | 192 | 26 |
| 20..... | 28 | 200 | 2 | | 198 | 23 |
| 24..... | 26 | 202 | 1 | | 201 | 21 |
| 28..... | 25 | 203 | | | 203 | 20 |
| 32..... | 24 | 204 | | | 204 | 19 |
| 36..... | 23 | 208 | 3 | | 205 | 18 |
| 40..... | 23 | 211 | 4 | | 207 | 18 |
| 44..... | 18 | 211 | 3 | | 208 | 14 |
| 48..... | 15 | 211 | 2 | | 209 | 11 |
| 52..... | 12 | 212 | 1 | | 211 | 8 |
| 56..... | 5 | 215 | 2 | | 213 | 4 |

From the data given in Tables 2 and 3 the conclusion can be safely drawn that castration causes a moderate acceleration of growth in body length in guinea pigs after they have reached a certain age. The acceleration of growth in body length is fairly regular and so mild that the type of growth curve in body length of the castrated animals presents hardly any significant difference from that of the controls, as will be seen in fig. 2. It is interesting to note in this connection that the increase of growth in body length is proportional to that of growth in body weight and that the normal relation between the body length and the body weight characteristic for the series is scarcely modified by the operation. Taking the observed average body length as the basis for computation, in castrated guinea pigs it is 364.2 per cent, and in the controls 357.5 per cent.

THE GROWTH IN HEIGHT AND BODY CIRCUMFERENCE

The term "height" here refers to the distance from the level of the posterior or dorsal angle of the scapula to the tip of the middle digit (excluding the claw), the measurement being taken

with the limb fully extended; and the term "body circumference" means the circumference of the trunk taken immediately behind the level of the angle of the scapula. This point was selected for taking the body circumference as it is not subject to much fluctuation arising from the condition of the stomach and intestines.

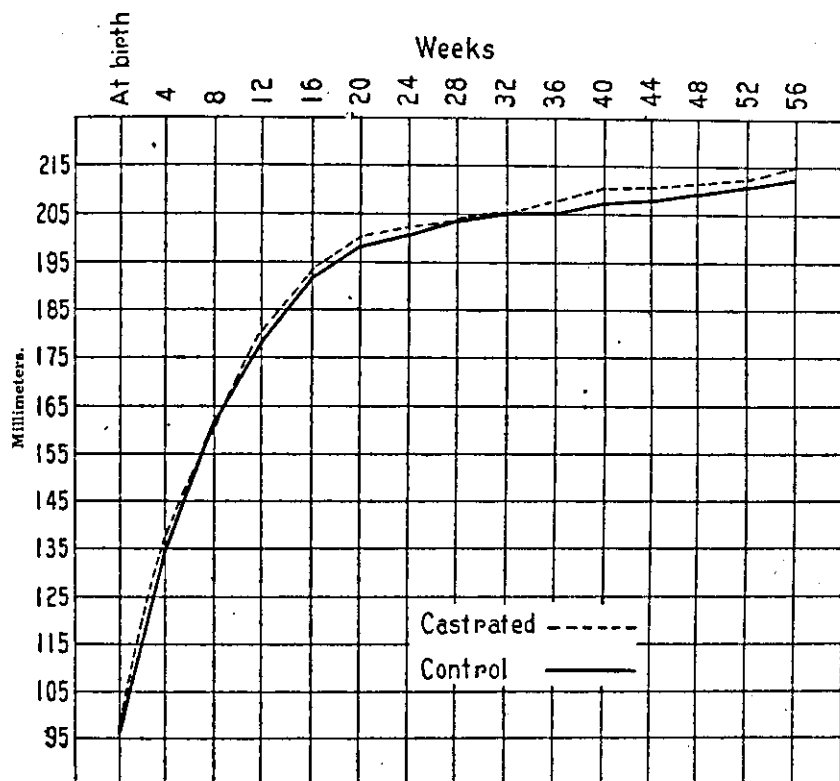


FIG. 2. Showing the curves of growth in body length of the castrates and the controls as plotted from data in Table 3.

I was unable to find records of any attempt to find out what influence castration has upon the actual height and body circumference of the animals. Most of the investigators consulted claim that castration, when performed in early life and before sexual maturity has been reached, is followed by a change in general body conformation, and that the bones of the castrated animals, such as guinea pigs, oxen, rabbits, dogs, and chickens, become longer than normal. If this is the effect of castration on the long bones, as a natural result the castrated animals will

become taller than the non-castrated or those that are entire, in as much as the height of an individual depends largely, if not wholly, upon the length of the long bones of the limbs.

Table 4 gives the average heights of the castrated animals and controls at different ages; it will be noted from this table that at birth the controls are 8 millimeters higher than the castrates, but after the age of eight weeks, or about two weeks after the

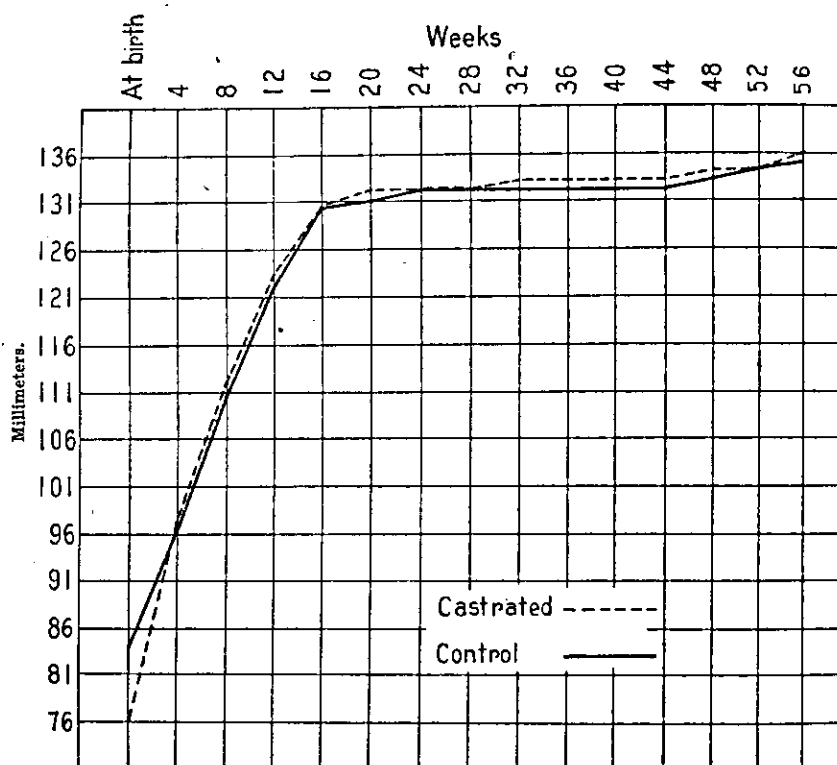


FIG. 3. Curves of growth in height of the castrates and the controls as plotted from data in Table 4.

operation, the castrated animals slightly exceed the controls in height. The similarity in height of the castrates and the controls at certain ages, for which merely incidental influences may account, appears to bear no particular significance in the interpretation of the results of this part of the experiment. As will be noted from fig. 3 the growth curves in height of the castrated and the control animals present no striking dissimilarity.

Examination of the data in Table 5 will show that the castrated guinea pigs after the age of twenty weeks, or about

fourteen weeks after they were operated upon, slightly exceed their controls in body circumference. Despite the similarity of the body circumference of the castrates and controls at the ages of forty and forty-four weeks, as will be noted from Table 5, the castrated animals record an average of 2 millimeters every four weeks. The character of the growth curve in body circumference of the castrated animals, in spite of slight irregularity of body growth, does not differ very much from that of the controls, as illustrated in fig. 4.

TABLE 4.—Average heights¹ of the castrated and control guinea pigs at different ages.

| Age. | Castrated cases. | Height. | Excess in favor of— | | Height. | Control cases. |
|---------------|------------------|---------|---------------------|----------|---------|----------------|
| | | | Castrated. | Control. | | |
| Weeks. | | mm. | mm. | mm. | mm. | |
| At birth..... | 35 | 76 | | 8 | 84 | 29 |
| 4..... | 35 | 97 | | | 97 | 29 |
| 8..... | 35 | 112 | 1 | | 111 | 29 |
| 12..... | 32 | 124 | 1 | | 123 | 26 |
| 16..... | 32 | 130 | | | 130 | 26 |
| 20..... | 28 | 132 | 1 | | 131 | 23 |
| 24..... | 26 | 132 | | | 132 | 21 |
| 28..... | 25 | 132 | | | 132 | 20 |
| 32..... | 24 | 133 | 1 | | 132 | 19 |
| 36..... | 23 | 133 | 1 | | 132 | 18 |
| 40..... | 23 | 133 | 1 | | 132 | 18 |
| 44..... | 18 | 133 | 1 | | 132 | 14 |
| 48..... | 15 | 134 | 1 | | 133 | 11 |
| 52..... | 12 | 134 | | | 134 | 8 |
| 56..... | 5 | 136 | 1 | | 135 | 4 |

The data given in Tables 4 and 5 show that castration in young and immature guinea pigs causes a slight acceleration in growth in height and body circumference. It may be noted in this connection that this acceleration is proportional to that of the growth in body length, as evidenced by the fact that the normal relation between the body length and height and body circumference is not materially affected. Taking the observed body length as the basis for computation,¹ the height of castrated animals is 63.78 per cent as compared with 64.08 per cent for the controls, and the body circumference of the castrated animals is 86.02 per cent in contrast with 86.47 per cent for the controls.

¹In computing the percentage relation between the body length, body weight, height, and body circumference, only the records of animals from twenty-four to fifty-six weeks old were used.

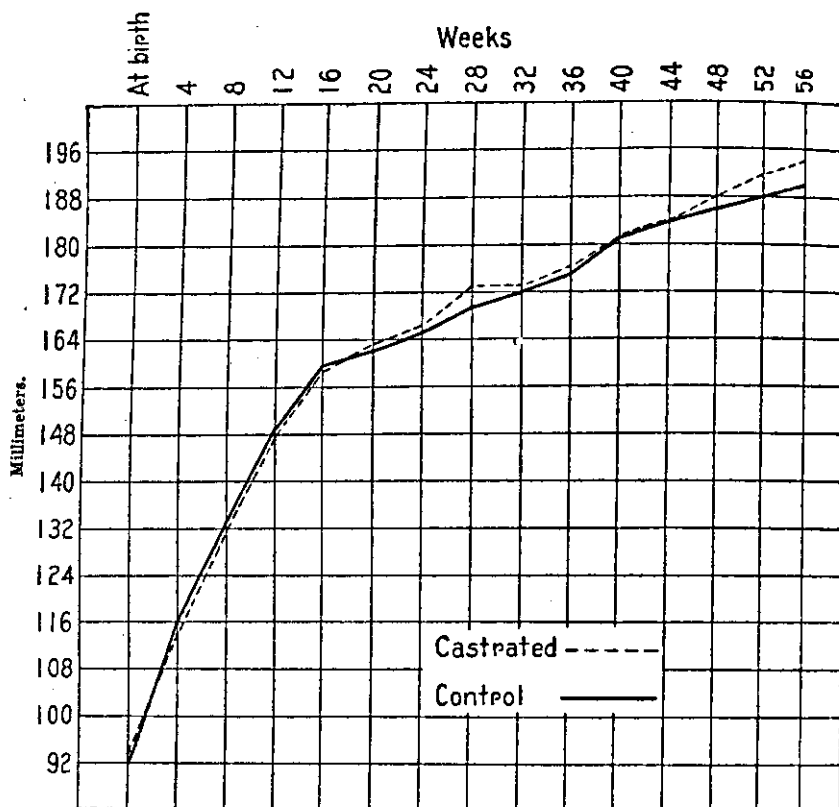


FIG. 4. Curves of growth in body circumference of the castrates and the controls as plotted from data in Table 5.

TABLE 5.—Average body circumferences of the castrated and control guinea pigs at different ages.

| Age. | Castrated cases. | Body circumference. | Excess in favor of— | | Body circumference. | Control cases. |
|---------------|------------------|---------------------|---------------------|----------|---------------------|----------------|
| | | | Castrated. | Control. | | |
| Weeks. | | mm. | mm. | mm. | mm. | |
| At birth..... | 35 | 93 | 1 | | 92 | 29 |
| 4..... | 35 | 115 | | 1 | 116 | 29 |
| 8..... | 35 | 132 | | 1 | 133 | 29 |
| 12..... | 32 | 148 | | 1 | 149 | 26 |
| 16..... | 32 | 158 | | 1 | 159 | 26 |
| 20..... | 28 | 163 | 1 | | 162 | 23 |
| 24..... | 26 | 166 | 1 | | 165 | 21 |
| 28..... | 25 | 173 | 4 | | 169 | 20 |
| 32..... | 24 | 173 | 1 | | 172 | 19 |
| 36..... | 23 | 177 | 1 | | 176 | 18 |
| 40..... | 23 | 181 | | | 181 | 18 |
| 44..... | 18 | 184 | | | 184 | 14 |
| 48..... | 15 | 188 | 2 | | 186 | 14 |
| 52..... | 12 | 192 | 4 | | 188 | 8 |
| 56..... | 5 | 194 | 4 | | 190 | 4 |

THE AMOUNT AND DISTRIBUTION OF FAT AND THE INTERNAL ORGANS

The bodies of the castrated and the control animals from twenty litters were dissected and examined for the comparative amount and distribution of fat. The internal organs were removed one by one, freed from fat and other adhering connective tissues, and their respective weights determined. Care was observed to prevent, as much as possible, the organs from drying. For the removal of the organs from their attachments in the body walls the following order proved to be the most satisfactory: Liver, spleen, pancreas, stomach, small intestine, large intestine, kidneys, adrenals, lungs, and heart. It may be stated here that the contents of the stomach and intestines were carefully and gently removed, using no water, before the organs were weighed; the lungs were cut at the bifurcation of the trachea; and the pericardium was not included in the weighing of the heart.

With the exception of the presence in the castrated animals of a large and apparently well-organized lobe of fat in each mammary gland and in the subcutaneous tissue extending from the base of each gland to the inguinal region, the amount and general distribution of fat in the body of the castrates were practically the same as in the case of the controls. This finding agrees for the most part with that of Launois and Roy,⁽¹⁰⁾ but is contrary to the general conception that castration is followed by excessive deposition of fat. The observation of Brumley⁽¹⁾ on dogs may hold true also in guinea pigs, "that there is not the tendency to obesity when castration is performed at an early age."

The figures in Table 6 represent the average weights of the various internal organs of the sacrificed twenty-five castrated and twenty control animals from twenty litters. The percentage of the individual organ was computed by dividing the average weight of the organ by the average of the weights of the castrates or controls at the time they were killed. By referring to the average weights and percentages of the individual organs given in Table 6 it will be noted that the data for the castrates and for controls are practically identical. Thus, it appears that the weights of the various internal organs in guinea pigs and the percentage of the individual organ characteristic for the series are not modified by castration.

TABLE 6.—Average weights and average percentages of the individual organs of guinea pigs.

| Organ. | Castrated. | | Control. | |
|-----------------------|-----------------|-------------|-----------------|-------------|
| | Average weight. | Percentage. | Average weight. | Percentage. |
| | g. | | g. | |
| Liver | 33.96 | 4.182 | 33.62 | 4.134 |
| Spleen | 1.01 | 0.123 | 1.13 | 0.138 |
| Pancreas | 1.53 | 0.187 | 1.52 | 0.186 |
| Stomach | 5.47 | 0.669 | 5.61 | 0.689 |
| Small intestine | 13.34 | 1.633 | 13.29 | 1.634 |
| Large intestine | 16.35 | 2.002 | 18.12 | 2.228 |
| Right kidney | 2.13 | 0.260 | 2.12 | 0.260 |
| Left kidney | 2.09 | 0.255 | 2.18 | 0.267 |
| Right adrenal | 0.308 | 0.037 | 0.3 | 0.036 |
| Left adrenal | 0.308 | 0.037 | 0.302 | 0.037 |
| Heart | 2.74 | 0.335 | 2.76 | 0.340 |
| Lungs | 6.26 | 0.766 | 6.55 | 0.806 |

THE LONG BONES OF THE LIMB

In Table 8 are given the actual lengths of the left humerus, radius, femur, and tibia of castrated and control animals in twenty litters; the same bones were used in getting the data for Table 9. In litters where there were two or more castrates, as in litters 1, 2, 5, and 15, only the averages of the lengths and of the weights of their long bones are given in the tables. It will be noted in Table 8 that in 60 per cent of the litters the castrated animals have longer bones than the controls. The excess, however, is neither uniform for the different bones of the same animal nor for the same bone in different animals. In this table the percentage of excess was computed by dividing the excess (difference) by the length of the bone of the control. Computing from the average length of the bones of castrated and control guinea pigs, the percentage of excess of the bones of the castrated animals was found to be as follows: Humerus, 2.8; radius, 3.2; femur, 2.4; and tibia, 2.2. For comparison, the percentage of excess in length of some bones in chickens, guinea pigs, and dogs, as noted by former observers, is presented in Table 7.

Table 9 shows that in 65 per cent of the litters the bones of the castrated animals are slightly heavier than those of their controls. By comparing the data in Table 8 with those in Table 9, it will be noted that, with the exception of litter 7, the animals having longer bones are also the ones that are affected here. This condition seems to suggest that increase in length of the

bones in castrated animals is accompanied by a corresponding increase in weight. In this experiment no attempt was made to determine the thickness of the bones of castrated animals which, according to Launois and Roy, (10) is also increased by castration. It will be further noted from Table 9 that the percentages of excess in weight are neither uniform in the different bones of the same individual nor in the same bone of different animals. The table also shows that the percentages of excess in weight of the long bones of the castrated guinea pigs are as follows: Humerus, 16.8; radius and ulna, 29.8; femur, 10.9; and tibia, 10.1.

TABLE 7.—Percentages of excess in length of some bones in animals, as noted by various observers.

| Author. | Animal. | | Femur. | Tibia. |
|-----------------------|---------------------|--|------------------|------------------|
| | | | <i>Per cent.</i> | <i>Per cent.</i> |
| Pirsche | Capon A | | 9 | 12.6 |
| Do | Capon B | | 12 | 8.2 |
| Launois and Roy | Guinea pig 1 | | | |
| Do | Guinea pig 2 | | | |
| Poncet | Castrated dog | | 21.4 | 12.0 |

| Author. | Right femur. | Left femur. | Right tibia. | Left tibia. | Right humerus. | Left humerus. |
|-----------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| | <i>Per cent.</i> | <i>Per cent.</i> | <i>Per cent.</i> | <i>Per cent.</i> | <i>Per cent.</i> | <i>Per cent.</i> |
| Pirsche | | | | | | |
| Do | | | | | | |
| Launois and Roy | 5.6 | 6.8 | 6.4 | 7.5 | 2.6 | 2.6 |
| Do | 7.9 | 6.8 | 8.6 | 8.0 | 7.0 | 9.0 |
| Poncet | | | | | | |

SUMMARY AND CONCLUSIONS

1. Castration of young and growing guinea pigs not only develops the attitude and temperament peculiar to the females, but it also removes that restlessness ascribed to the impelling impulses for sexual intercourse.

2. With the exception of the penis, which appears to be somewhat undersized, all the secondary sexual organs in general remain infantile in type after castration.

3. Castration tends to cause a moderate acceleration of growth in body weight, body length, height, and body circumference. The acceleration, however, in these directions does not occur simultaneously nor immediately after the operation; it appears that the increase in body length and height begins to manifest

TABLE 8.—Actual lengths of the long bones of castrated and control guinea pigs and the percentages of excess.

| Litter. | Humerus. | | | Radius. | | | Femur. | | | Tibia. | | |
|--------------|------------|----------|-----------|------------|----------|-----------|------------|----------|-----------|------------|----------|-----------|
| | Castrated. | Control. | Excess. | Castrated. | Control. | Excess. | Castrated. | Control. | Excess. | Castrated. | Control. | Excess. |
| | mm. | mm. | Per cent. | mm. | mm. | Per cent. | mm. | mm. | Per cent. | mm. | mm. | Per cent. |
| 1..... | 36 | 35 | 2.8 | 32 | 31 | 3.2 | 42 | 41 | 2.4 | 48 | 47 | 2.1 |
| 2..... | 36 | 36 | | 32 | 32 | | 42 | 42 | | 46 | 46 | |
| 3..... | 37 | 36 | 2.7 | 33 | 32 | 3.1 | 43 | 42 | 2.3 | 48 | 47 | 2.1 |
| 4..... | 35 | 34 | 2.9 | 32 | 31 | 3.2 | 40 | 39 | 2.5 | 45 | 44 | 2.2 |
| 5..... | 37 | 36 | 2.7 | 33 | 31 | 6.4 | 43 | 40 | 7.5 | 48 | 45 | 6.6 |
| 6..... | 37 | 34 | 8.8 | 33 | 31 | 6.4 | 43 | 41 | 4.8 | 47 | 45 | 4.4 |
| 7..... | 36 | 36 | | 32 | 32 | | 43 | 43 | | 47 | 47 | |
| 8..... | 37 | 36 | 2.7 | 32 | 31 | 3.2 | 43 | 41 | 4.8 | 48 | 46 | 4.3 |
| 9..... | 35 | 35 | | 32 | 32 | | 42 | 42 | | 46 | 46 | |
| 10..... | 36 | 36 | | 32 | 32 | | 42 | 42 | | 46 | 46 | |
| 11..... | 37 | 35 | 5.7 | 34 | 32 | 6.2 | 43 | 41 | 4.8 | 49 | 46 | 6.5 |
| 12..... | 33 | 33 | | 30 | 30 | | 40 | 40 | | 44 | 44 | |
| 13..... | 36 | 36 | | 33 | 33 | | 42 | 42 | | 47 | 47 | |
| 14..... | 37 | 34 | 8.8 | 34 | 31 | 9.6 | 42 | 40 | 5. | 48 | 45 | 6.6 |
| 15..... | 36 | 35 | 2.8 | 33 | 32 | 3.1 | 43 | 42 | 2.3 | 48 | 47 | 2.1 |
| 16..... | 35 | 35 | | 32 | 32 | | 41 | 41 | | 45 | 45 | |
| 17..... | 36 | 36 | | 32 | 32 | | 41 | 41 | | 45 | 45 | |
| 18..... | 38 | 37 | 2.7 | 34 | 33 | 3 | 44 | 43 | 2.3 | 49 | 47 | 4.2 |
| 19..... | 35 | 34 | 2.9 | 32 | 31 | 3.2 | 42 | 41 | 2.4 | 46 | 44 | 4.5 |
| 20..... | 38 | 37 | 2.7 | 34 | 33 | 3. | 45 | 44 | 2.2 | 48 | 47 | 2.1 |
| Average..... | 36 | 35 | 2.8 | 32 | 31 | 3.2 | 42 | 41 | 2.4 | 47 | 46 | 2.2 |

TABLE 9.—Weights of the long bones of the limbs of castrated and control guinea pigs and the percentages of excess.

| Litter. | Humerus. | | | Radius and ulna. | | | Femur. | | | Tibia. | | |
|--------------|------------|----------|-----------|------------------|----------|-----------|------------|----------|-----------|------------|----------|-----------|
| | Castrated. | Control. | Excess. | Castrated. | Control. | Excess. | Castrated. | Control. | Excess. | Castrated. | Control. | Excess. |
| | cg. | cg. | Per cent. | cg. | cg. | Per cent. | cg. | cg. | Per cent. | cg. | cg. | Per cent. |
| 1..... | 80 | 70 | 14.2 | 63 | 50 | 20 | 160 | 130 | 23 | 110 | 90 | 22.2 |
| 2..... | 80 | 80 | | 60 | 60 | | 130 | 130 | | 80 | 80 | |
| 3..... | 80 | 70 | 14.2 | 60 | 50 | 20 | 140 | 120 | 16.6 | 100 | 90 | 11.1 |
| 4..... | 90 | 80 | 12.5 | 70 | 60 | 16.5 | 150 | 120 | 25 | 90 | 70 | 28.5 |
| 5..... | 90 | 80 | 12.5 | 60 | 50 | 20 | 160 | 130 | 23 | 100 | 90 | 11.1 |
| 6..... | 100 | 70 | 42.8 | 70 | 50 | 28.5 | 140 | 120 | 16.6 | 100 | 90 | 11.1 |
| 7..... | 80 | 70 | 14.2 | 60 | 50 | 20 | 140 | 120 | 16.6 | 100 | 90 | 11.1 |
| 8..... | 100 | 80 | 25 | 70 | 60 | 16.6 | 150 | 130 | 15.3 | 100 | 90 | 11.1 |
| 9..... | 80 | 80 | | 60 | 60 | | 130 | 130 | | 90 | 90 | |
| 10..... | 80 | 80 | | 60 | 60 | | 130 | 130 | | 90 | 90 | |
| 11..... | 80 | 70 | 14.2 | 70 | 60 | 16.6 | 140 | 130 | 7.6 | 100 | 90 | 11.1 |
| 12..... | 60 | 60 | | 50 | 50 | | 120 | 100 | 20 | 90 | 80 | 12.5 |
| 13..... | 80 | 80 | | 60 | 60 | | 130 | 130 | | 100 | 100 | |
| 14..... | 90 | 80 | 12.5 | 70 | 60 | 16.6 | 140 | 130 | 7.6 | 100 | 90 | 11.1 |
| 15..... | 80 | 70 | 14.2 | 70 | 60 | 16.6 | 140 | 130 | 7.6 | 100 | 90 | 11.1 |
| 16..... | 90 | 90 | | 60 | 60 | | 140 | 140 | | 90 | 90 | |
| 17..... | 80 | 80 | | 60 | 60 | | 120 | 120 | | 90 | 90 | |
| 18..... | 90 | 80 | 12.5 | 70 | 60 | 16.6 | 150 | 140 | 7.1 | 130 | 100 | 30 |
| 19..... | 80 | 70 | 14.2 | 60 | 50 | 20 | 150 | 120 | 25 | 90 | 80 | 12.5 |
| 20..... | 100 | 90 | 11.1 | 70 | 60 | 16.6 | 180 | 160 | 12.5 | 100 | 90 | 11.1 |
| Average..... | 80 | 77 | 16.8 | 64 | 57 | 29.8 | 142 | 128 | 10.9 | 98 | 89 | 10.1 |

itself only when the castrated animal is approaching the age of maturity, and the increase in body weight and body circumference only when it has reached or passed the age of maturity. The explanation of this condition that can at present be offered is that probably the formative energy in the body of the animal before the age of maturity is mostly directed toward the development of the framework or harder structures of the animal body, and only after this framework has been developed to a certain stage does the formative energy become proportionally divided among the hard and soft constituents of the body for their further growth and development.

4. The acceleration of growth of the different parts of the body after the age of maturity is fairly regular and harmonious, so that their normal relation is hardly affected; in other words, the general body conformation characteristic for a certain individual remains practically unmodified after castration.

5. The acceleration of body growth incident to castration does not materially alter the normal types of growth curves in body weight, body length, height, and body circumference.

6. The weights of the internal organs and the deposition of fat in the body are not influenced by castration in young and immature animals.

7. The vertebral column and the long bones of the limbs, besides being somewhat heavier, tend to grow slightly longer than normal after castration.

LITERATURE CITED

1. BRUMLEY, OSUR VICTOR. A textbook of the Diseases of the Small Domestic Animals (1921) 636 pp.
2. CREW, F. A. E. The effect of castration in the fowl. *Veterinary Journ.* 78 (1922) 27-30.
3. DOLLAR, JNO. A. W. Regional Veterinary Surgery and Operative Technique. London, Gay & Hancock, Ltd. (1920) 1114 pp.
4. DRAPER, R. L. The prenatal growth of the guinea-pig. *Anat. Rec.* 18 (1920) 369-392.
5. FICHERA, G. Sur l'hypertrophie de la glande pituitaire consécutive à la castrazione. *Arch. Ital. Biol.* 43 (1905) 405-426.
6. HATAI, SHINKISHI. The effect of castration, spaying or semi-spaying on the weights of the central nervous system and of the hypophysis of the albino rat; also the effect of semi-spaying on the remaining ovary. *Journ. Exp. Zool.* 15 (1913) 297-314.
7. HAYES, M. HORACE. Points of the Horse. 4th éd. (1903) 736 pp.
8. JACKSON, C. M. Postnatal growth and variability of the body and of the various organs in the albino rat. *Am. Journ. Anat.* 15 (1913) 1.

9. LANTZ, DAVID E. Raising guinea-pigs. U. S. Dept. Agr. Farmers' Bull. 525 (1913) 1-12.
10. LAUNOIS, P. E. and PIERRE ROY. Etudes Biologiques sur les Géouts. Paris, 1904. Cited by Hobday. See Ref. 18.
11. MARRASSINI, A. Sur les modifications que la castration peut déterminer dans les organes glandulaires de quelques animaux, et spécialement sur celles que l'on rencontre dans l'hypophyse. Arch. Ital. Biol. 53 (1910) 419-431.
12. MARRASSINI A. and L. LUCIANI. Effets de la castration sur l'hypophyse et sur d'autres glandulaires. Arch. Ital. Biol. 56 (1911) 395-432.
13. MARSHAL, F. H. A. On the effects of castration and ovariectomy upon sheep. Proc. Roy. Soc. B. 85 (1912).
14. MERILLAT, LOUIS A. Veterinary Surgical Operations. 2d ed. 3 (1918) 556.
15. PIRSCHKE, E. De l'influence de la castration sur le développement du squelette. Cited by Hobday. See Ref. 18.
16. PONCET. Cited in Stotsenberg. See Ref. 19.
17. PONCET. Congrès de l'Association Française pour l'Avancement des Sciences. Havre (1877). Cited by Hobday. See Ref. 18.
18. SHATTOCK, S. G. and C. G. SELIGMANN. Trans. Path. Soc. London 56 (1905) 57. Cited by Hobday. Castration and Ovariectomy, Edinburgh and London (1914) 160 pp.
19. STOTSENBERG, J. M. On the growth of the albino rat after castration. Anat. Rec. 3 (1909) 233.
20. THOMPSON, HENRY. Elementary Lectures on Veterinary Science. 4th ed. (1920) 524.

ILLUSTRATIONS

TEXT FIGURES

- FIG. 1. Diagram showing the curves of growth in body weight of the castrated and control guinea pigs as plotted from data in Table 1.
2. Diagram showing the curves of growth in body length of the castrated and control guinea pigs as plotted from data in Table 3.
3. Diagram showing the curves of growth in height of the castrated and control guinea pigs as plotted from data in Table 4.
4. Diagram showing the curves of growth in body circumference of the castrated and control guinea pigs as plotted from data in Table 5.

ECHINOCOCCUS CYST OF THE HUMAN LUNG

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NINE PLATES AND THREE TEXT FIGURES

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INTRODUCTION

Although one not infrequently meets with *Taenia* infestation of the intestine of both man and the lower animals, yet no report has heretofore been made in the Philippines of the occurrence of the larval stage of any cestode in the lung of a human being. Strong(15) recorded two cases of echinococcus cyst, one in the liver and the other in the omentum, observed at autopsy; and Garrison(8) learned from inquiry that another case had occurred in Manila. He stated, however, that the reports on this and Strong's cases were verbal and that no specimens appear to have been preserved.

Castellani and Chalmers,(4) without giving any specific reference to Philippine literature, briefly mention that hydatid disease is known in the Philippine Islands. Crowell and Hammack(5) found a case of extensive infestation with *Cysticercus cellulosæ* (Gmelin) among 500 autopsies, but none of echinococcus. Wharton,(16) apparently referring to the accounts of Strong and of Garrison, reports infestation of man with *Echinococcus granulosus* (Batsch) Rudolphi, 1805.

The case we are reporting is of unique interest in that it is the first of its kind found in this country. The condition is certainly very rare, as it is the only one among the 8,000 or more autopsies performed to date in the Manila City Morgue.

The echinococcus cysts were accidentally found by one of us (W. L.) on April 1, 1921, during the course of an autopsy of a case with a clinical diagnosis of cholelithiasis, empyema of the gall bladder, chronic cholecystitis, and cholæmia.

CLINICAL HISTORY OF THE PATIENT

B. V., female, 34 years, admitted to the Philippine General Hospital on March 28, 1921, complaining of pain in the right subcostal region, chills, and fever for three days. She had had two similar attacks during the period of one year. The attacks usually began with a colicky pain, always starting in the right subcostal region and radiating to the right side of the chest and right shoulder, always accompanied by chills, fever, and vomiting, lasting for one week, but without jaundice. The present attack was of much greater intensity, the colicky pains coming on more frequently and the day after the onset jaundice was noticed in the eyes, accompanied by morning rigors and fever.

She was conscious on admission, temperature 38° C., but restless and moaning due to pain. There was generalized jaundice.

The lungs and heart were good.

Abdomen showed slight distension over the upper right quadrant where there were rigidity and tenderness. The spleen was distinctly enlarged. The lower border of the liver could not be made out. At the region of the gall bladder, there was palpated an oblong mass where tenderness was marked and percussion dull (distended and inflamed gall bladder).

The condition became worse daily and on the morning of the day of death she became delirious and restless and the jaundice intense.

NECROPSY FINDINGS AND ANATOMIC DIAGNOSIS

Skin and conjunctivæ icteric. There were adhesions between right lobe of liver and diaphragm and between spleen and peritoneum. Mesenteric lymph nodes enlarged, soft, and congested. Diaphragm on the right side at level of fourth rib and on the left at level of fourth interspace.

Heart small. Conglomerated petechial hæmorrhages at anterior surface of left ventricle. Coronary vessels tortuous and

prominent. Cardiac musculature slightly increased in consistency, brownish yellow, the valves in good condition.

The right lung showed pleural petechial hæmorrhages. Crepitation diminished. No consolidations. The left lung showed at apex small hard nodules bound together by excessive growth of connective tissue with the adjacent pleura. Two fluctuating cystic areas palpated at the lower lobe near the root, the larger one 6 centimeters in diameter, the smaller 4. The cysts were perfectly spherical and entirely filled with a clear, thin, brownish fluid. Floating in this fluid and loosely attached to the inner lining of the cysts were innumerable small, white, flattened granules. These had indented borders and were soft. They measured 2 millimeters in diameter and were uniform in shape and size. The wall of the cysts was smooth. The cysts were entirely closed to the surrounding lung tissue. The lining of the cysts was tough and strong. The lung tissue surrounding the cysts was dense and atelectatic. The rest of the lung tissue was congested.

Spleen very much enlarged; weight, 485 grams. Capsule slightly thickened with broken fibrous tags on surface. It was soft and flabby. Section showed opaque, dull pinkish, diffuent and abundant pulp tissue which scraped off easily.

Liver enlarged and greenish yellow, the capsule thick, showing numerous fibrous tissue tags. In places it was indurated, but in other places friable. Small abscesses on the surface were seen, abundant and prominent along the biliary tracts on the cut surface. They averaged roughly 2 to 3 centimeters in diameter. There were so many in the right lobe that this portion looked as if it consisted of cavities with anastomosing papillary growths. In both the large and the small bile ducts were found elongated, black, easily broken calculi. Gall bladder distended with thick yellowish brown bile. In the cystic duct a large calculus completely obstructed biliary drainage.

Alimentary tract showed evidence of congestion of the mucosa. Pancreas and adrenals also congested.

Kidneys normal in size. The cut surface showed slight connective tissue increase, bulging cortex, injected vessels and glomeruli, and opaque, granular, pinkish parenchyma.

Uterus small. The mucosa showed slight bleeding. Ovaries indurated, the tubes congested.

Anatomic diagnosis.—Septicæmia, cholelithiasis; cholangitic abscesses; empyema, gall bladder; chronic cholecystitis; acute nephritis; acute splenic tumor; chronic apical tuberculosis, left side, with adhesions; echinococcus polymorphus, left lung.

Bacterial findings.—Smears and cultures from spleen, liver, and gall bladder showed colon bacilli.

Histological findings.—Abscesses and marked passive congestion in the liver. Lung showed atelectasis with cysts and tuberculosis and passive congestion. Kidney œdematous, congested, and degenerated. Heart showed œdema, interfibrillar hæmorrhage, fragmentation, and degeneration.

STUDY OF THE HYDATID CYST

Gross examination.—The gross appearance and size of the hydatid has already been referred to in the autopsy report.

MICROSCOPIC STUDY OF THE MATERIAL AND DISCUSSION AS TO MANNER OF FORMATION

WHOLE BROOD CAPSULES

The whitish granules mentioned in the protocol are the brood capsules. These are irregularly distributed on the inner surface of the mother cyst. Most of them are enmeshed in the gelatinous meshwork of the germinal layer; some are already loose in the liquid of the hydatid. They look like bunches of grapes in miniature. They contain multiple scoleces in different stages of development. In some the rostellum with two rows of spines is apparent, in others the suckers (Plate 2, fig. 6). The brood capsules nearest the wall of the mother cyst were not seen to be attached by any definite stalk but by a condensed gelatinous substance. Plate 2, fig. 4, shows a single and a whole brood capsule.

SECTIONS OF THE CYST AND ITS CONTENTS

Cyst wall.—The cyst wall consists of three coats: An outer (Plate 4, fig. 12, *a*), mainly compact connective tissue derived from condensation of the lung tissue immediately surrounding the hydatid; a middle layer (Plate 4, fig. 12, *b*), a homogenous laminated cuticle, the ectocyst proper; and an internal (Plate 4, fig. 12, *c*), germinal or parenchymatous layer, the endocyst. The endocyst is composed of two portions; namely, an inner, consisting of cellular elements, and an outer, the basement membrane.

The cyst covering is uniform in thickness (about 136 μ) except at certain points where it may be very much thinner than the rest of the wall (Plate 5, fig. 18), due to the thinning out of the laminated layer. There may, however, be an over-

growth in some portions of the ectocyst (Plate 5, fig. 17). The cyst wall may have a wavelike appearance (Plate 4, fig. 13).

In trying to peel off the cyst wall from the surrounding tissue, it was noticed that the wall could be separated only with difficulty at certain points; study of the cross sections involving the lung furnishes the explanation. Plate 4, fig. 11, shows the connective tissue layer delving into the laminated layer to become lost in its stratification. Plate 5, fig. 15, shows a portion of the connective tissue prolongation which has already become a part of the ectocyst.

Brood capsules.—At first the cuticular membrane incloses no organized structures, but contains only fluid. It is practically in a bladderlike condition, which is called an "acephalocyst." Later, presumably through proliferation of the germinal layer, the "vesicules proligeres," or brood capsules, are evolved and differentiated (Plate 2, figs. 4, 5, 6, 7; Plate 3, fig. 9).

Study of our sections shows that they are already in an advanced stage, so that their actual origin from the parenchymatous layer cannot be conclusively determined. However, it is noted that the cavity of the brood capsule is lined by a thin cuticle which is similar in structure to the basement membrane in the cyst wall (Plate 8, figs. 27 and 29).

Nevertheless, opinion differs as to how the brood capsules may arise. Stephens(6) makes this conjecture:

The order of the layers is just the reverse in them to what it is in the parent cyst, that is to say, they have inside a thin non-laminated cuticle and the parenchymatous layer on the external surface. These, theoretically at least, may be regarded as invaginations of the bladder-wall giving rise to a cavity with the cuticle internal and the parenchymatous layer external. If we suppose the orifice to close, we should then get an isolated cavity with cuticle internal and parenchymatous layer external, as in the brood capsule.

Stephens's diagram would thus include the thick laminated layer in the invagination. From the study of our sections we venture to think differently—that probably the proliferation of the parenchymatous layer toward the inside of the cyst cavity drags the basement membrane and causes it to invaginate and form the lining of the hollow of the brood capsule, without involving the laminated stratum. This view is supported to some extent by the fact that the basement membrane with the germinal layer separates very easily from the laminated layer. (Plate 4, figs. 12 and 14; Plate 5, figs. 15 and 17).

Scolec..—The scoleces, or heads, of the succeeding generation of *tæniæ* develop from the brood capsules, but observers are not entirely agreed as to the manner of their formation. Leuckart's views represent the old ideas of Wagener, Naunyn, Rasmussen, and Vuillemin, while Moniez takes the opposite stand.

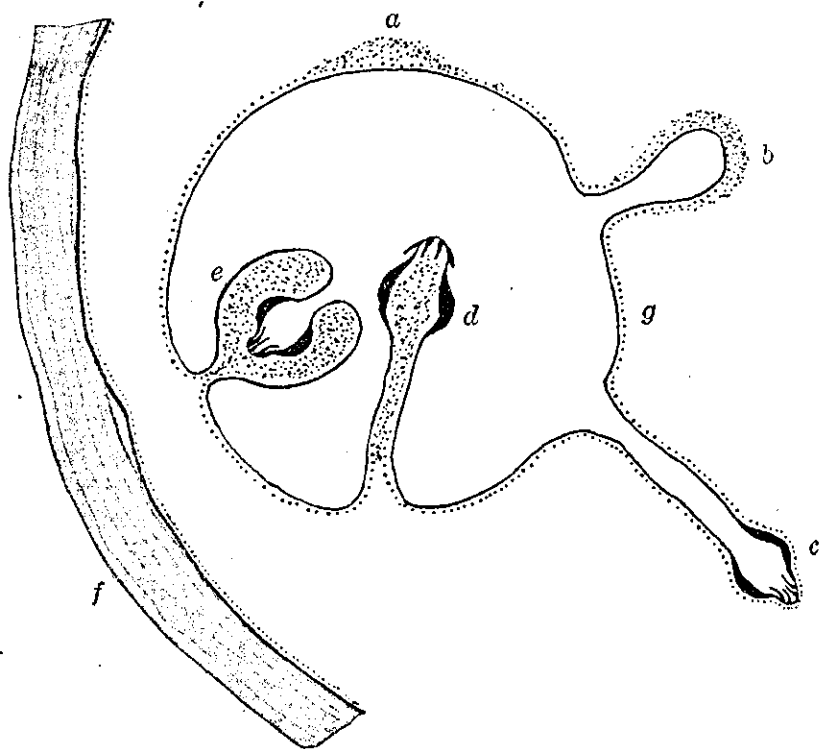


FIG. 1. Diagrammatic representation of mode of formation of the scolex, according to Leuckart; a, anlage of the head, thickening of the parenchymatous layer; b, the proliferation of cells growing out into the cavity of the hydatid cyst, at the same time carrying into it a diverticulum of the brood capsule; c, formation of the scolex with its hooklets; d, invagination of the diverticulum and more proliferation of the germinal cells; e, the rostellum and suckers invaginate into the posterior portion of the scolex; f, cyst wall, composed of the ectocyst, the laminated layer externally and the endocyst internally, the latter consisting of a basement membrane and a cellular layer represented by the dotted line; g, wall of the brood capsule.

According to Leuckart(10) the "Anlage" of the head is a disklike thickening of the parenchymatous layer which forms the covering of the brood capsule (fig. 1, a). This proliferation of cells grows out into the cavity of the hydatid cyst, at the same time carrying into it a diverticulum of the brood capsule (fig. 1, b). At the bottom of this hollow bud or "Hohlknospe"

is formed the scolex with its hooklets and suckers (fig. 1, *c*). The specimen figured in Plate 7, fig. 24, may be said to represent this stage. The hollow scolex which arose at first as an evagination of the wall of the brood capsule now invaginates.

Our sections show that, probably soon after this invagination, an intense proliferation of the germinal cells takes place between the walls of the diverticulum; so that, instead of a hollow scolex, we have now a solid process projecting into the cavity of the brood capsule (fig. 1, *d*; Plate 8, figs. 28 and 29; Plate 9, figs. 30 and 31). The constriction at the base is seen early in this stage. Lastly, the rostellum and suckers become invaginated into the posterior portion of the scolex (fig. 1, *e*), and this becomes more constricted at the base (Plate 7, fig. 24). The latter is the last stage in the formation of the mature scolex.

One can thus follow the cuticle and germinal layer of the hollow process with the aid of the accompanying diagram (fig. 1). Through the various evaginations and invaginations, the stage is finally reached where the round bud (fig. 1, *e*; Plate 6, fig. 22; Plate 8, fig. 27) projects into the cavity of the brood capsule with the rostellum and suckers withdrawn into the posterior portion of the scolex. The thin stalk may break off and there are loose heads (Plate 3, fig. 9; Plate 7, fig. 23), sometimes called "sands," inside the brood capsule.

Leuckart observed a high degree of contractility of the "Hohlknospe" which is responsible for the turning out and in of such diverticula. This is due to the presence of a good system of musculature which differentiates and develops early in the germinal walls of the hollow scolex, as has been worked out by Goldschmidt.⁽⁹⁾ This feature is very evident in our sections as shown in the different stages of either contraction or extension of the bodies of the scoleces inside the brood capsule (Plate 8, figs. 28 and 29; Plate 9, figs. 30 and 31).

Besides the exogenous development of the "Hohlknospe," Leuckart states that the hollow process may grow into the inside of the brood capsule very early and here the development is completed. Regarding this point Goldschmidt⁽⁹⁾ makes this statement:

Neben dieser von Leuckart als typisch angesehenen exogenen Entwicklung soll es auch vorkommen, dass die Hohlknospen auf einem frühern Stadium in das Innere gelangen und hier ihre Entwicklung vollenden, wobei sie aber zu dem zuletzt erfolgenden Zurückziehen des Vorderendes Hohlknospen bleiben.

Moniez,(12) on the other hand, contradicts the views of Leuckart. He states that the first "Anlage" of the head (fig. 2, *a*) grows directly on the inside toward the cavity of the brood capsule, and not toward the hollow of the hydatid cyst. Furthermore, it always remains solid and there is never any trace of a diverticulum in the whole developmental history, from the "Anlage" to the mature scolex (fig. 2, *a*, *b*, *c*, *d*).

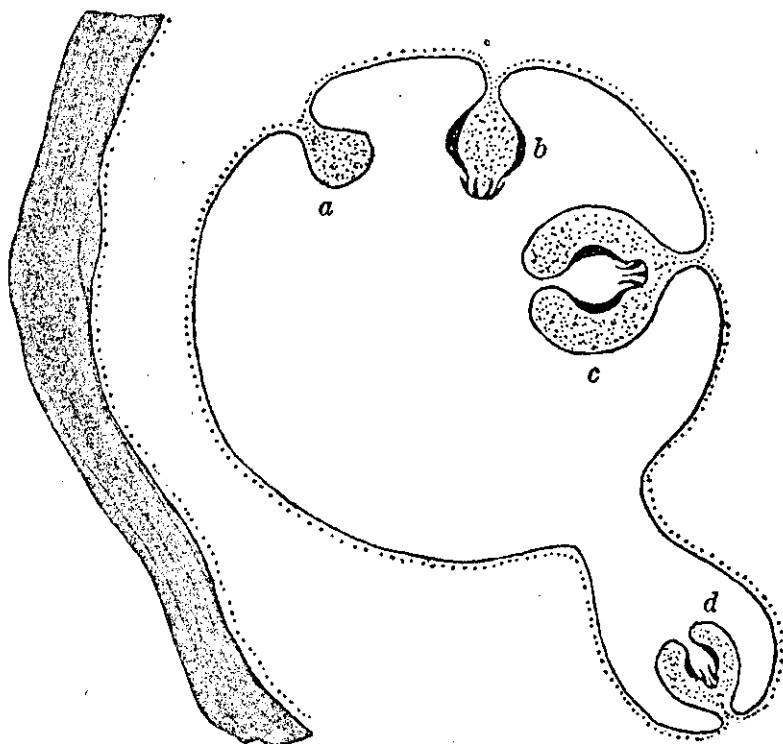


FIG. 2. Diagrammatic representation of mode of formation of the scolex, according to Moniez; *a*, first anlage of the head growing directly into the inside of the brood capsule; *b* and *c*, transformations of the developing scolex; *d*, scolex developing on the wall of a diverticulum of the brood capsule.

However, it is admitted by Moniez that he has observed the so-called exogenous "Hohlknospen" of Leuckart, but he has a different interpretation for them. He believes that the hollow process is simply a diverticulum of the brood capsule wall which may even separate and form an independent brood capsule. At the bottom of such an evaginated brood capsule wall, according to him, the head arises, which develops after the endogenous manner of formation already referred to (fig. 2, *d*).

In one of our cross sections of the brood capsules (Plate 9, fig. 30) there can be seen growths on the wall which may simulate the Moniez manner of formation of the head; but on closer analysis it will be observed that they are peduncular parts of the scolex body cut tangentially, so that they seemingly have lost their connections with the rostellar portions.

The researches of Goldschmidt(9) afford data by which the contradictory views of Leuckart and Moniez may be more or less harmonized.

Goldschmidt's account is as follows: The development on the wall of the brood capsule is introduced by a proliferation of the parenchymatous coat at certain places of the brood capsule (fig. 3, *a*). A small knoblike structure is formed, the base of which is covered by the already thickened cuticle. While this knob grows further, it raises itself gradually on the surface of the brood capsule. Coincident with this there, goes on another

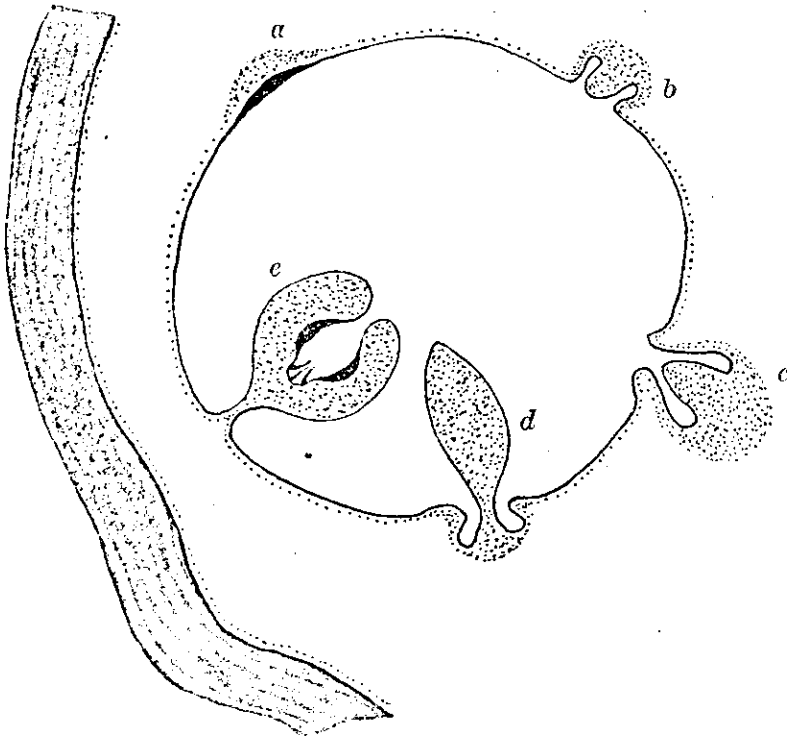


FIG. 3. Diagrammatic representation of mode of formation of the scolex, according to Goldschmidt: *a*, proliferation of the parenchymatous coat and thickening of the cuticle; *b*, formation of a circular furrow, or sulcus; *c*, the furrow deepens, giving rise to a tongue-like structure, the anlage of the rostellar part of the head; *d*, the tongue-like structure further projects into the cavity of the brood capsule; *e*, mature scolex.

process, initiated by the cuticle, which is the formation of a circular furrow or sulcus (fig. 3, b). This furrow deepens, thereby bringing into prominence a tonguelike structure which is the "Anlage" of the rostellar part of the head. This stage would correspond to Leuckart's diverticulum, or "Hohlknospe." It also would represent a stage which Moniez might have interpreted as formation of the head directly from the inside of the brood capsule, especially when the tonguelike structure further projects into the cavity of the brood capsule. Goldschmidt states that if one is not careful in the preparation and sectioning of the broods, he is liable to miss the formation of the furrow.

Rostellum and suckers.—The rostellar portion is formed early. Goldschmidt, who studied the evolutionary development of this stage of the worm, states that there take place as the last steps the turning in of the rostellar "Anlage" and the closing in afterward of the cuticle over it (Plate 9, figs. 28 and 29; Goldschmidt's figs. 10 and 11). Our specimens evidently would represent fig. 11 of Goldschmidt.

Lower down from the rostellar portion is found the beginning of the formation of the suckers. This is represented by the concave disk formation with the concavity directed outward, and by a strong proliferation of the parenchyma cells around the concavity (Plate 9, fig. 31).

Following this stage is the interesting invagination of the rostellum with the hooks (Plate 5, fig. 18). This is carried to completion as shown in Plate 6, fig. 22, which represents a longitudinal section. It will be noted that by this time the suckers are nearly organized. Plate 8, fig. 26, shows a section through the invaginated scolex at the stage in which the suckers are still communicating with each other. Plate 6, figs. 19, 20, and 21, shows horizontal sections passing about the region of the insertion of the hooks. The much-thickened cuticula in this portion of the scolex is well shown.

LIFE HISTORY OF THE PARASITE

The hydatid or echinococcus cyst, technically known as *Echinococcus polymorphus* Diesing, is only one stage, the larval stage, in the life cycle of a cestode worm. Both the larval and the adult forms have been given different names by various observers at different times, which resulted in no little confusion in the past. The peculiarly long list of synonyms as given by Stiles(13) will illustrate this point.

Other names for the adult worm (*Taenia echinococcus* Siebold, 1853) are:

1. "*Taenia cateniformis*" misdet. pro parte Rudolphi, 1808.
2. "*Taenia cucumerina* Bloch" misdet. pro parte, Diesing, 1850.
3. "*Taenia serrata*" misdet. Roll, 1852.
4. *Taenia echinococcus* Siebold (1853).
5. *Taenia nana* Beneden, 1858 (nec Siebold, 1852).
6. *Taenia* (*Echinococcifer*) *echinococcus* of Leuckart, 1863.
7. *Taenia* (*Arhynchotaenia*) *echinococcus* of Diesing, 1864.
8. *Taenia* (*Echinococcus*) *echinococcus* of Railliet, 1886.
9. *Taenia* "*echinokokkus*" of Schneidemuhl, 1896.

Other names for the larval stage (*Echinococcus polymorphus* Diesing, 1850) are:

1. *Taenia visceralis socialis granulosa* Goeze, 1782.
2. *Hydatigena granulosa* Batsch, 1786.
3. *Vesicaria granulosa* (Batsch) Schrank (1788).
4. *Taenia granulosa* (Batsch) Gmelin, 1790.
5. *Polycephalus hominis* Zeder, 1800.
6. *Echinococcus* Rudolphi, 1802.
7. *Polycephalus humanus* Zeder, 1803.
8. *Polycephalus granulosis* (Batsch) Zeder, 1803.
9. *Polycephalus echinococcus* Zeder, 1803.
10. *Acephalocystis* Laennec, 1804.
11. *Echinococcus granulosis* (Batsch) Rudolphi, 1805.
12. *Hydatid erratica* Blumenbach, 1805.
13. *Acephalocystis humana* Lundersen (1808).
14. *Acephalocystis suilla* Lundersen (1808).
15. *Echinococcus hominis* (Zeder) Rudolphi, 1810.
16. *Echinococcus simiae* Rudolphi, 1810.
17. *Echinococcus veterinorum* Rudolphi, 1810.
18. *Polycephalus granosis* Laennec, 1812.
19. *Acephalocystis ovoidea* Laennec, 1812.
20. *Acephalocystis cystifera* Laennec, 1812.
21. *Acephalocystis granosa* Laennec, 1812.
22. *Acephalocystis surculigera* Laennec, 1812.
23. *Acephalocystis intersecta* Laennec, 1812.
24. *Acephalocystis ansa* Laennec, 1812.
25. *Echinococcus infusorium* F. S. Leuckart (1827).
26. *Acephalocystis eremita sterilis* Cruvielhiehl (?).
27. *Acephalocystis prolifera socialis* Cruvielhiehl (?).
28. *Acephalocystis endogena* Kuhn (1830).
29. *Acephalocystis exogena* Kuhn (1830).
30. *Acephalocystis granulosa* Chiaje, 1833.
31. *Acephalocystis communis* Chiaje, 1833.
32. *Acephalocystis prolifera* Chiaje, 1833.
33. *Acephalocystis simplex* Goodsir, 1844.
34. (??) *Diskostoma acephalocystis* Goodsir, 1844.
35. (??) *Astoma acephalocystis* Goodsir, 1844.
36. *Echinococcus arietis* E. Blanchard, 1848.

37. *Echinococcus giraffae* Gervais (?).
38. *Echinococcus polymorphus* Diesing, 1850.
39. *Echinococcus pardi* Huxley (1852).
40. *Echinococcus scolicipariens* Kuchenmeister, 1855.
41. (?) *Acephalocystis macaci* Cobbold, 1861.
42. (?) *Acephalocystis ovis tragelaphi* Cobbold, 1861.
43. *Cysticercus echinococcus* (Zeder) Koeberlé, 1861.
44. *Echinococcus cerebri* Spiering, 1862.
45. *Echinococcus hepatis* seu process, vermiformis Scholler, 1862.
46. *Echinococcus hydatidosus* R. Leuckart, 1863.
47. *Echinococcus endogena* (Kuhn, 1830) Leuckart, 1863.
48. *Echinococcus multilocularis* Leuckart, 1863.
49. *Echinococcus lienis* Kehlberg, 1873.
50. *Echinococcus pulmonum* Huppert, 1875.
51. *Echinococcus multilocularis hepatis* Haffter, 1875.
52. *Echinococcus intercranialis* Fricke, 1880.
53. *Echinococcus simplex* Leuckart, 1880.
54. *Echinococcus racemosus* Leuckart, 1880.
55. *Echinococcus multiplex* Stiller, 1882.
56. *Echinococcus alveolaris* R. Blanchard, 1886.
57. *Echinococcus retroperitonialis* Bitter, 1886.
58. *Echinococcus mesenterii* Surman, 1891.
59. *Echinococcus cerebri* Perroncito (18...).
60. *Echinococcus cysticus* Huber, 1891.
61. *Echinococcus unilocularis* Huber, 1896.
62. *Echinococcus multilocularis exulcerans* Huber, 1896.
63. *Echinococcus osteoklastes* Huber (?) 1896.
64. *Echinococcus subphrenicus* Huber, 1896.
65. "*Echinokokkus*" (!) of Schneidemuhl, 1896.

The adult tænia (Plate 1, fig. 2) measures 2 to 6 millimeters in length and consists of three to four segments. The head is described as having a double row of hooklets in the rostellum. In our specimen (Plate 1, fig. 3), which was obtained from a dog, there is an inner row of 18 large hooklets and an outer row of 18 small hooklets. It commonly lives in the intestine of dogs, jackals, wolves, and cats. It has never been found in man.

The larval form has been found in various organs, frequently in the liver and lungs of sheep, pigs, and man, and many other species of mammals.

The cycle may be represented as starting from an egg which is liberated from a ripe segment. Upon arriving in the stomach of an intermediate host (for example, sheep) the eggshell is destroyed and the 6-hooked embryo now bores its way through the intestinal wall and wanders to the various organs of the body; that is, liver, lungs, or other viscera. Here it develops into a simple bladderlike structure, containing fluid but no

scolecex. This stage is called the "acephalocyst." This may develop further into the mature echinococcus containing brood capsules with scolecex. In case this stage develops in man, the life history of the parasite may end here. If it occurs in swine, cattle, or sheep, the story may be different. Where the offal of these animals is carelessly given to dogs, the life cycle of the parasite may thus be completed.

To recapitulate, *Echinococcus* is a parasitic cestode which has the dog for the primary host, as that animal harbors the adult stage of the worm; man, swine, cattle, and sheep are the secondary or intermediate hosts.

INCIDENCE

Echinococcus disease of man must be rare in the Philippines, judging from the autopsy records of the Manila City Morgue. It is however cosmopolitan in distribution, and it can really be axiomatically stated that "the echinococcus disease is as widely distributed as is the dog." It is however more prevalent in certain places than in others. It is common in Iceland, Australia, and New Zealand, and in certain parts of South America and Europe. It has been reported also from the United States and Canada. Lyon, (11) up to 1902, collected in all 240 cases from North America. Of these, the percentage distribution by organs ran as follows: 73.7 per cent were encountered in the liver; 10.8, in the omentum, peritoneal cavity, peritoneum, mesentery; and 4.5, in the lung.

The right lung seems to be more often affected than the left lung. The cysts may be either single or multiple. They may occur in only one lung, or simultaneously in both lungs. The cases in which such distribution is reported are shown in Table 1.

Statistics have been published showing influence of age, sex, and race on incidence of echinococcus infestation; but, as far as the biological attributes of the parasite are concerned, there seems to be no special predilection toward any such item, as the main factor is undoubtedly close association with infested dogs.

PATHOGENESIS

Cysts grow slowly, so that there is time for the tissues to make accommodations. The time of appearance of symptoms depends on the degree of tissue accommodation. The cyst may grow to the size of a child's head.

The hydatid may become absorbed, caseated or calcified, or secondarily infected.

TABLE 1.—Cases of *Echinococcus* infestation showing location of cysts in the lung.

[Number of + signs represents number of cysts.]

| Observer. | Country. | | | Date reported. |
|--------------------------|---------------------|--|--|----------------|
| Stone | United States | | | 1903 |
| Araz Alfaro | South America | | | 1919 |
| Buzzi | do | | | 1919 |
| Balboni | United States | | | |
| Do | do | | | |
| Alexander | Germany | | | 1921 |
| Ferro | Italy | | | 1921 |
| Cranwell and Vegas | | | | |
| De Leon and Leiva | Philippines | | | 1924 |

| Observer. | Involving— | | | Remarks. |
|--------------------------|-------------|------------|-------------|---|
| | Right lung. | Left lung. | Both lungs. | |
| Stone | | | + | Concurrent infestation of the liver. Case mentioned by Buzzi. |
| Araz Alfaro | Multiple | + | | |
| Buzzi | + + | | | Probable cyst of kidney. |
| Balboni | + | | | |
| Do | | | Multiple | Mentioned by Balboni. |
| Alexander | + | | | |
| Ferro | | | Multiple | |
| Cranwell and Vegas | + + | | | |
| De Leon and Leiva | | + + | | |

The cystic fluid is toxic. Rupture into the lung may prove fatal. The fluid will cause urticaria, rigors, local pain, and tenderness.

DIAGNOSIS

Complement fixation test and x-ray are two chief means of diagnosis. In case of rupture into a bronchus, finding of the hooklets and, possibly, pieces of laminated layer will establish the diagnosis.

PROPHYLAXIS AND TREATMENT

Guard dogs from being infected with the cystic stage around slaughter houses by eating infested meat. Avoid close association with dogs.

Surgical intervention is advised whenever practicable. Exposure to x-ray may be tried.

REFERENCES

1. ALEXANDER, H. Lungenechinokokkus und Pneumothorax-Behandlung. Zentralbl. f. Inn. Med. nr. 47, 41 (Nov. 20, 1920) 801.
2. BALBONI, G. M. Hydatid cyst of the lung. Boston Med. and Surg. Journ. 187 (1922) 879.
3. BUZZI, A. Sobre un caso de doble quiste hidatico de pulmon derecho. Lo Prensa Medica, Argentina, Buenos Aires, No. 4 (July 10, 1919) 42.
4. CASTELLANI, A., and A. J. CHALMERS. Manual of Tropical Medicine. Wm. Wood and Co., New York (1920).
5. CROWELL, B. C., and R. W. HAMMACK. Intestinal parasites encountered in five hundred autopsies, with reports of cases. Philip. Journ. Sci. § B 8 (1913) 157.
6. FANTHAM, H. B., J. W. W. STEPHENS, and F. V. THEOBALD. The Animal Parasites of Man. Wm. Wood and Co., New York (1916).
7. FERRO, P. Hydatid cysts of the lung. Riforma Med. No. 38 (September 21, 1921).
8. GARRISON, P. E. A preliminary report upon the specific identity of the cestode parasites of man in the Philippine Islands with a description of a new species of Taenia. Philip. Journ. Sci. § B 2 (1907) 537.
9. GOLDSCHMIDT, R. Zur Entwicklungsgeschichte der Echinococcus Köpfchen. Zoologische Jahrbücher Anat. 13 (1900) 467.
10. LEUCKART, R. Die Parasiten des Menschen und die von ihnen herrührenden Krankheiten. Leipzig u. Heidelberg 2. Aufl. (1879-1886).
11. LYON, I. P. A review of Echinococcus disease in North America. Am. Journ. Med. Sci. 123 (1902) 124.
12. MONIEZ, R. Essai monographique sur les Cysticerques. Paris (1880).
13. STILES, C. W. I. The flukes and tapeworms of cattle, sheep, and swine, with special reference to the inspection of meats. U. S. Dept. Agr. Bur. Anim. Industry Bull. No. 19 (1898) 113.
14. STONE, A. K. Echinococcus cysts of the liver and lungs. Boston Med. and Surg. Journ. 149 (1903) 263.
15. STRONG, R. P. Circulars on Tropical Diseases 1 (1901) 22.
16. WHARTON, L. D. The intestinal worms of dogs in the Philippine Islands. Journ. Parasitol., Urbana, Ill. 4 (1917) 80.

ILLUSTRATIONS

[Figures in plates 4 to 9 are microphotographs, $\times 2,750$. The specimens are sagittal sections except when otherwise specified.]

PLATE 1

- FIG. 1. Two cysts: *a*, one of the cysts found in the left lung which was opened to show the contents. It shows the granules (brood capsules) clinging on the wall of the hydatid; *b*, another echinococcus cyst, the larger of the two, cut open, with the contents removed.
2. The whole adult worm, *Taenia echinococcus*, whose body consists of three proglottids only. $\times 325$.
3. A more magnified photograph of the scolex showing the arrangement of an inner row of 18 large hooklets and an external row of 18 small hooklets on the rostellum.

PLATE 2

- FIG. 4. Single brood capsule with the scoleces inside. $\times 325$.
- FIGS. 5, 6, and 7. The brood capsule shown in fig. 4, at higher magnification. $\times 2750$.

PLATE 3

- FIG. 8. Section of part of the cyst and the adjoining lung tissue, showing the cut sections of the brood capsules.
9. The section shown in fig. 8, under lower magnification.
10. Connective tissue of the lung delving into the laminated layer of the cyst wall.

PLATE 4

- FIG. 11. The wavy outline of a portion of the cyst wall and the extreme thinning out of the wall at *x*.
12. *a*, condensation of connective tissue of the lung immediately surrounding the hydatid, forming a definite layer; *b*, ectocyst, the laminated layer; *c*, endocyst, the internal, germinal or parenchymatous layer, consisting of an outer basement membrane and an inner portion composed of cellular elements.
13. The connective tissue of the lung now forms part of the laminated layer. See the original delving in of such in fig. 10.
14. An island of laminated cuticle surrounded by the connective-tissue layer.

PLATE 5

- FIG. 15. A portion of the cyst wall showing irregularity of thickness of the laminated layer.
16. Thinning of the laminated cuticle at this region.

- FIG. 17. Separation of the parenchymatous layer from the laminated cuticle.
 18. Invagination of the rostellum with the hooks into the main portion of the bud.

PLATE 6

- FIG. 19. Horizontal section of an invaginated scolex. Section plane passing about the region of the insertion of the hooks.
 20. The same as fig. 19.
 21. The same as fig. 19.
 22. Complete invagination of the rostellum into the body of the scolex, the beginning of which is evident in fig. 18.

PLATE 7

- FIG. 23. The thin stalk at x may break off and scoleces become loose inside the brood capsule.
 24. Constriction of the base of the scolex forming the typical stalk connecting a scolex with the wall of the brood capsule; x , formation of a scolex in a diverticulum directed into the cavity of the hydatid.
 25. One of the scoleces, showing the formation of the suckers. The suckers are in a stage in which they are still communicating with each other.

PLATE 8

- FIG. 26. One of the scoleces, showing the formation of the suckers. The suckers are in a stage in which they are still communicating with each other.
 27. The round bud projects into the cavity of the brood capsule. The rostellum and suckers are withdrawn into the posterior portion of the scolex.
 FIGS. 28 and 29. Immature buds. These are the ones that will later invaginate and form the mature scoleces.

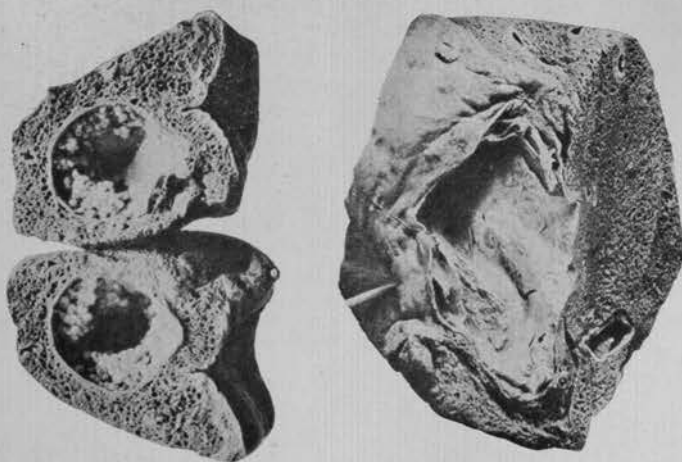
PLATE 9

- FIGS. 30 and 31. Immature buds that will later invaginate and form the mature scoleces.

TEXT FIGURES

- FIG. 1. Diagrammatic representation of mode of formation of the scolex, according to Leuckart; *a*, anlage of the head, thickening of the parenchymatous layer; *b*, the proliferation of cells growing out into the cavity of the hydatid cyst, at the same time carrying into it a diverticulum of the brood capsule; *c*, formation of the scolex with its hooklets; *d*, invagination of the diverticulum and more proliferation of the germinal cells; *e*, the rostellum and suckers invaginate into the posterior portion of the scolex; *f*, cyst wall, composed of the ectocyst, the laminated layer externally and the endocyst internally, the latter consisting of a basement membrane and a cellular layer represented by the dotted line; *g*, wall of the brood capsule.

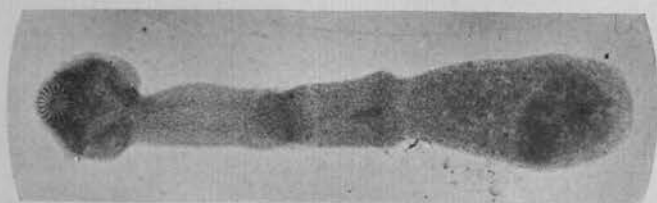
- FIG. 2. Diagrammatic representation of mode of formation of the scolex, according to Moniez; *a*, first anlage of the head growing directly into the inside of the brood capsule; *b* and *c*, transformations of the developing scolex; *d*, scolex developing on the wall of a diverticulum of the brood capsule.
3. Diagrammatic representation of mode of formation of the scolex, according to Goldschmidt; *a*, proliferation of the parenchymatous coat and thickening of the cuticle; *b*, formation of a circular furrow, or sulcus; *c*, the furrow deepens, giving rise to a tonguelike structure, the anlage of the rostellar part of the head; *d*, the tonguelike structure further projects into the cavity of the brood capsule; *e*, mature scolex.



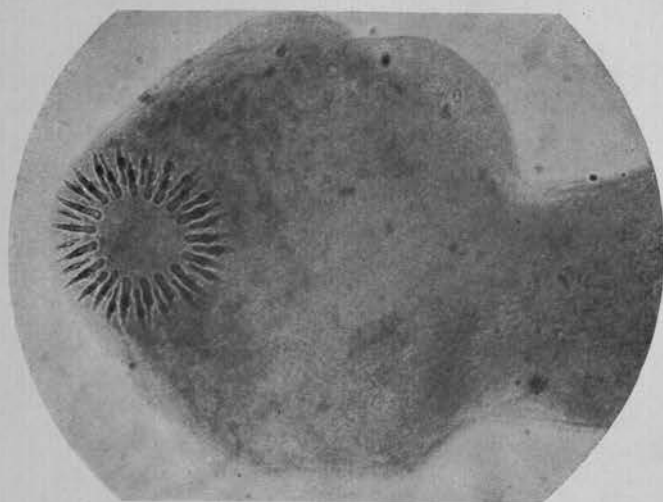
a

1

b



2



3

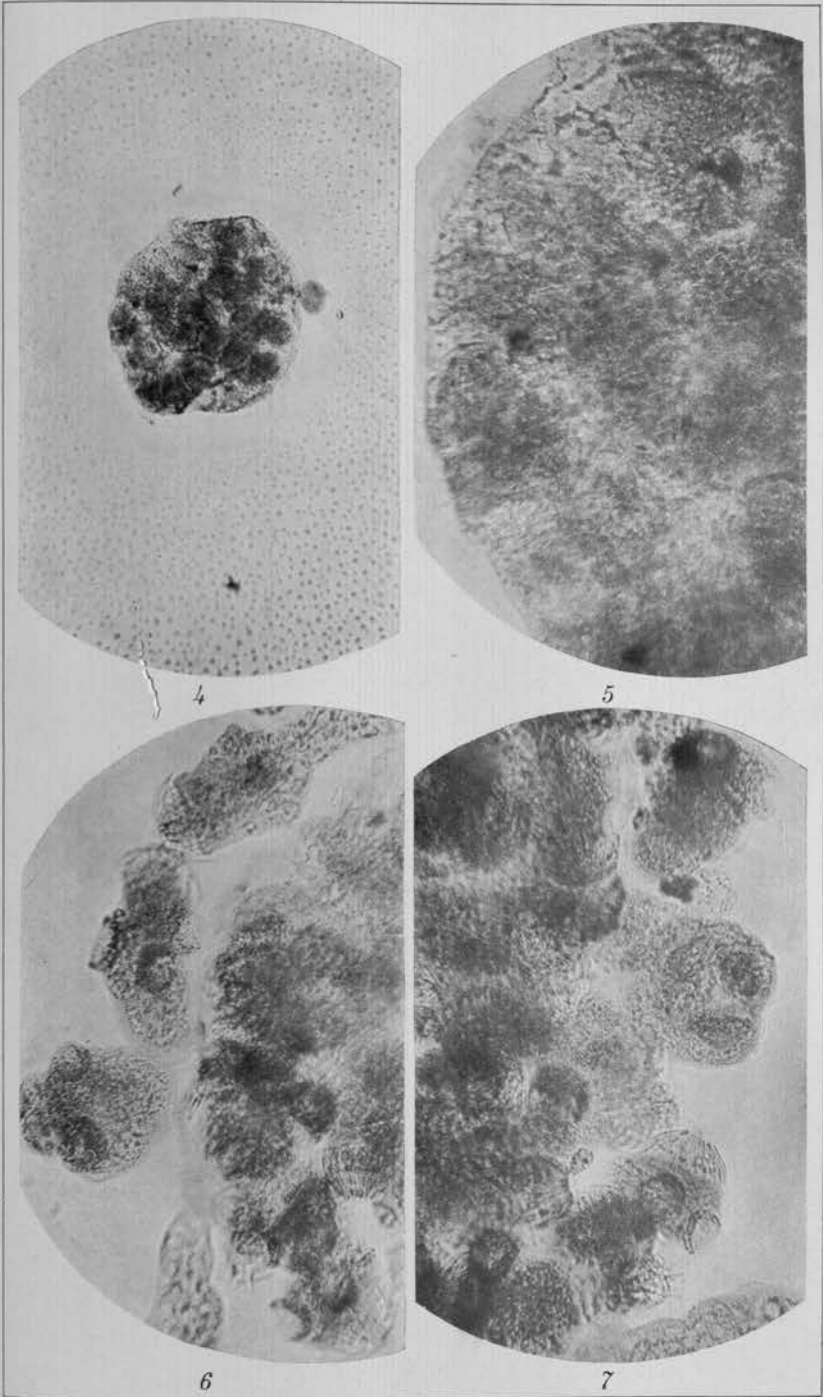


PLATE 2.

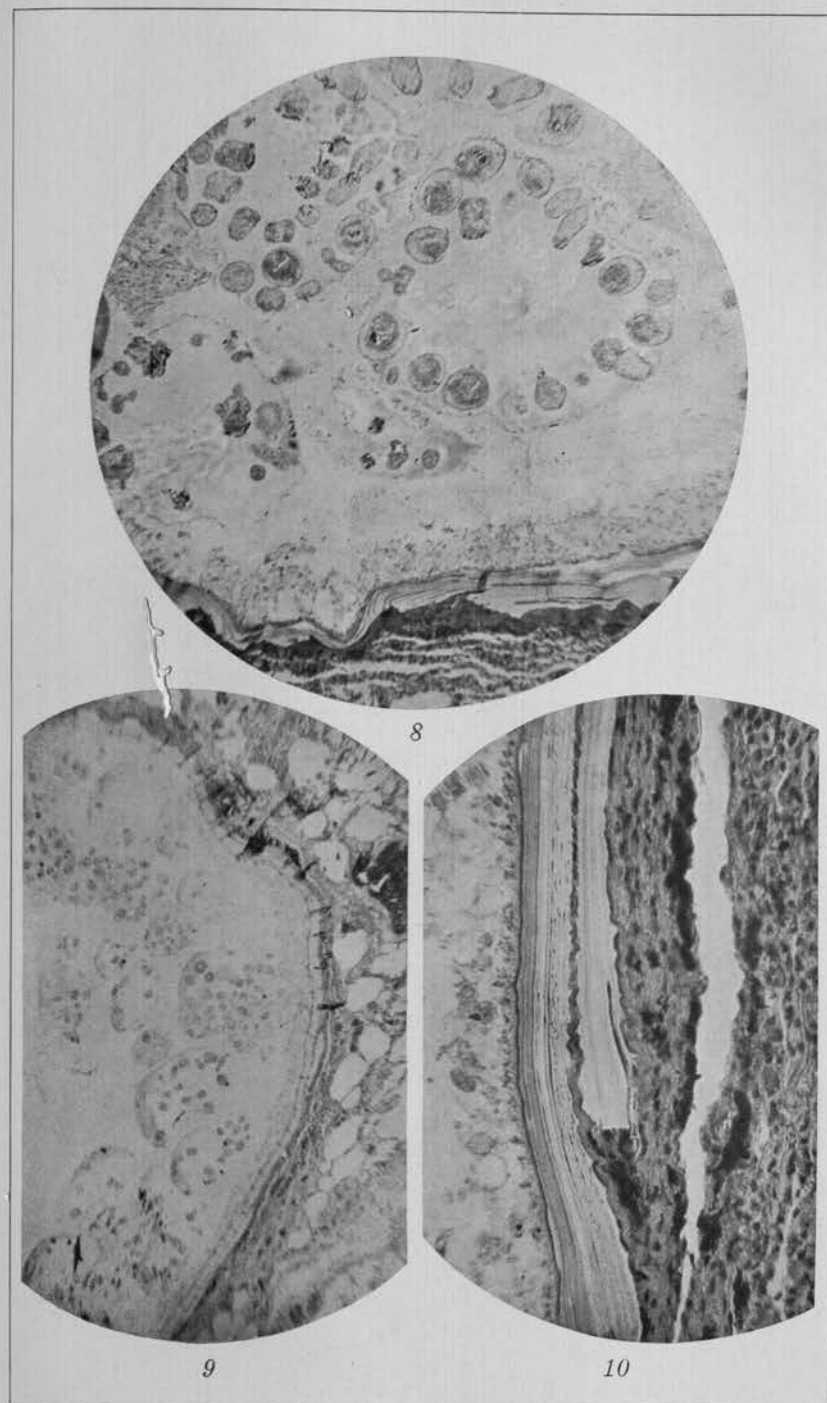


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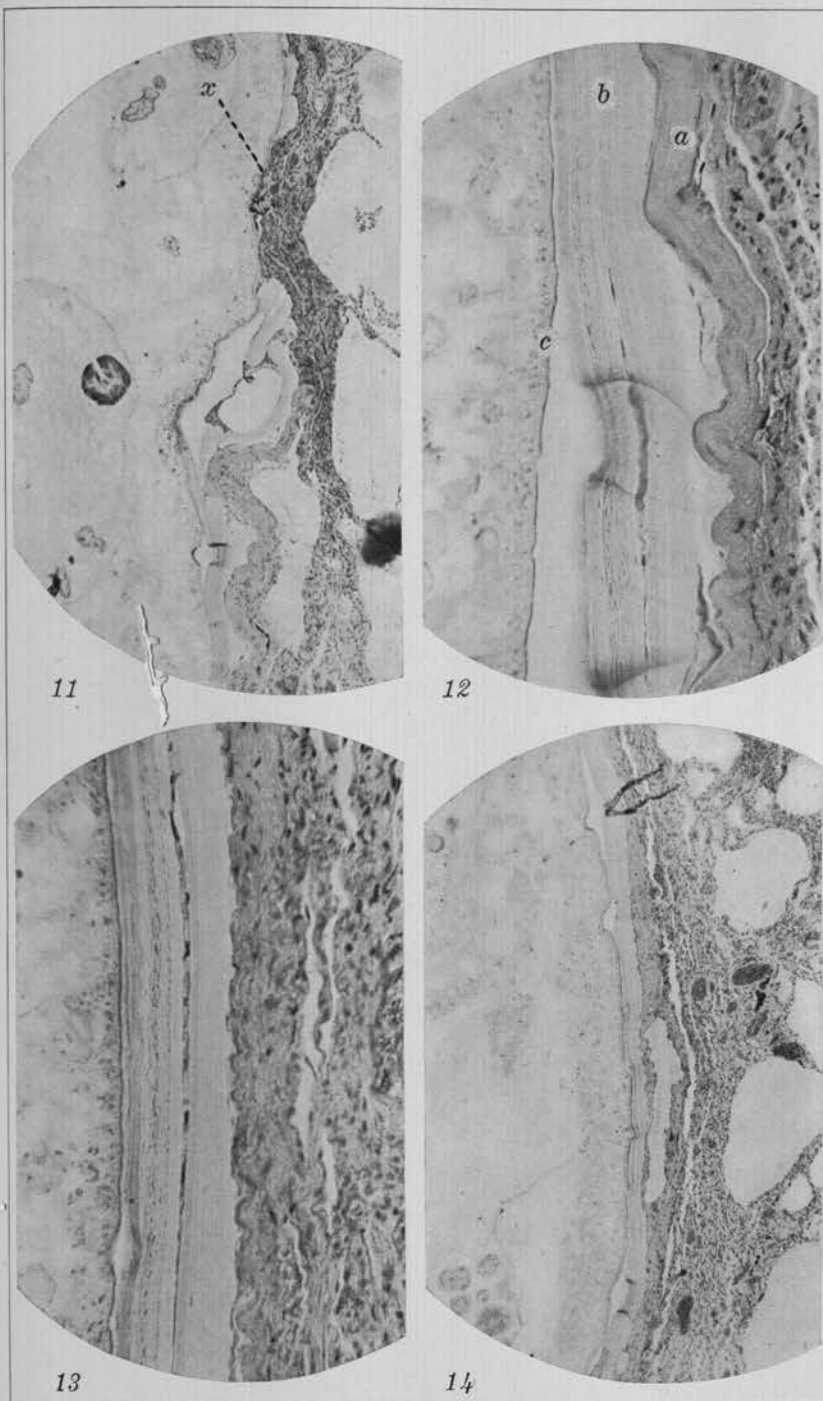
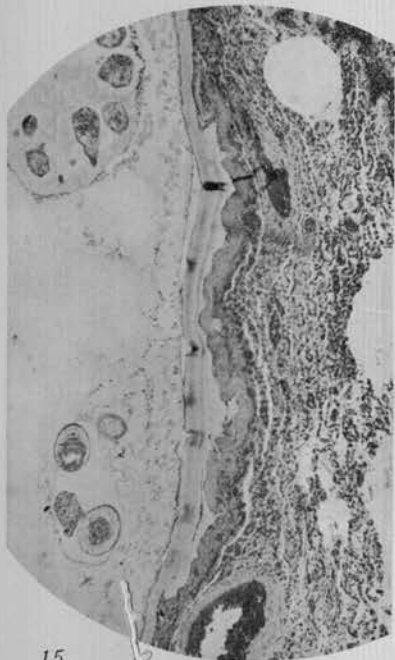
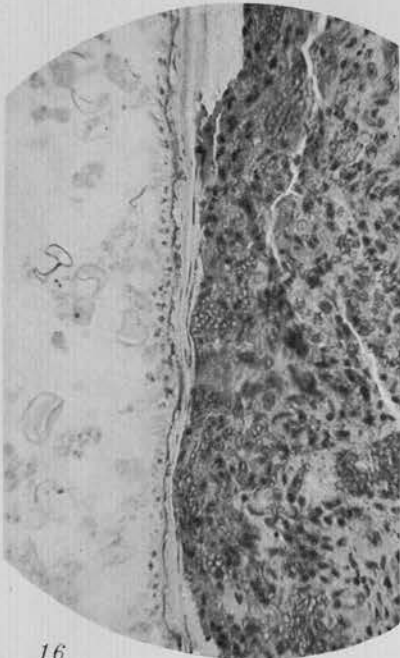


PLATE 4.



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18

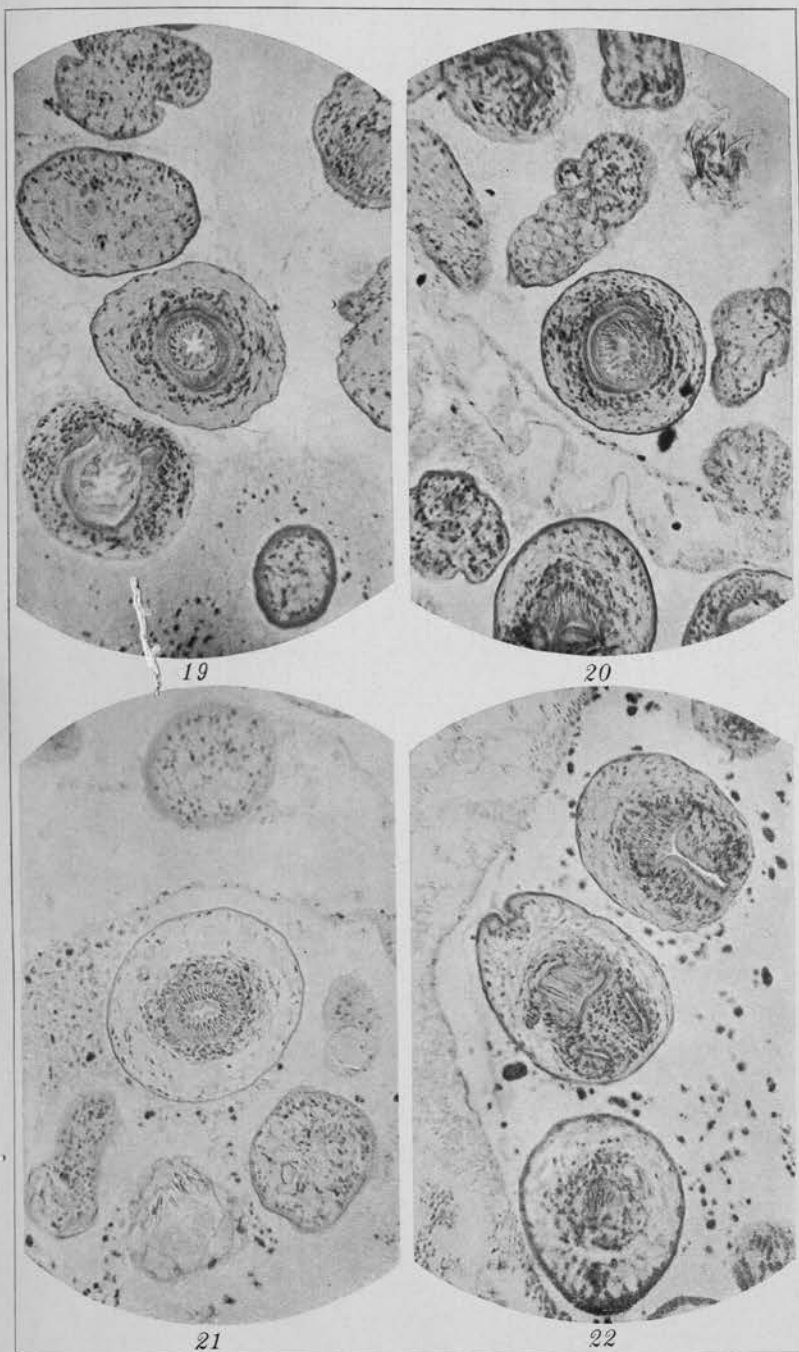
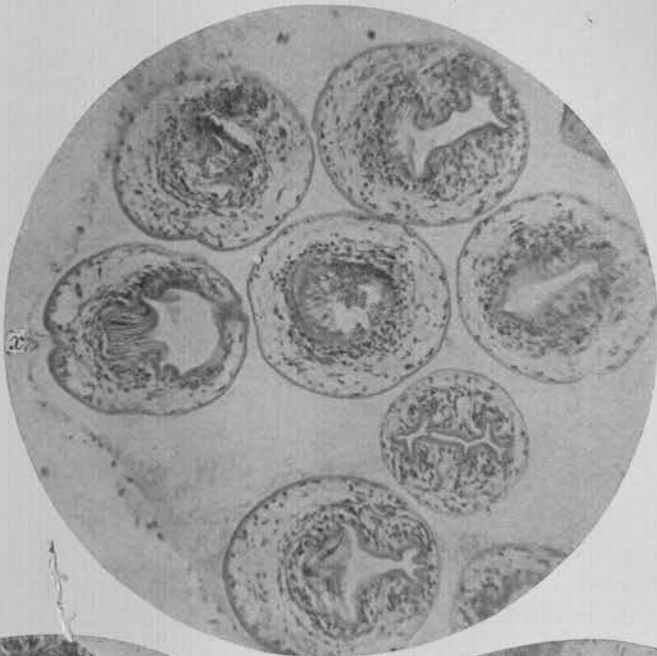
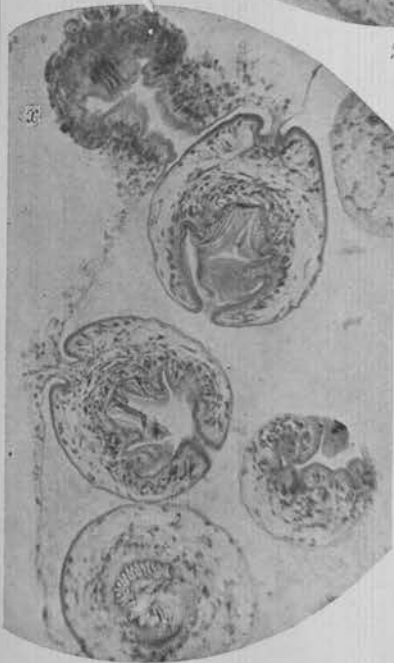


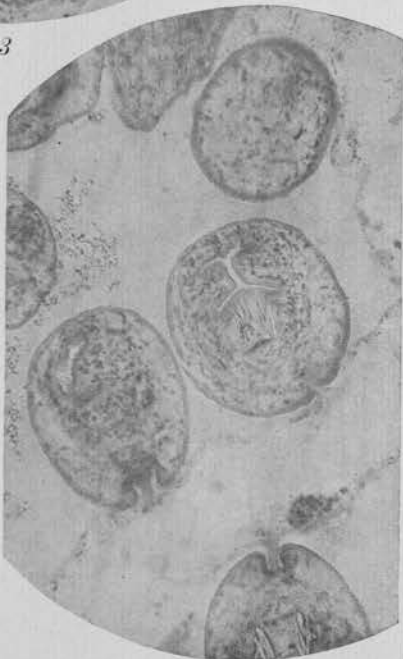
PLATE 6.



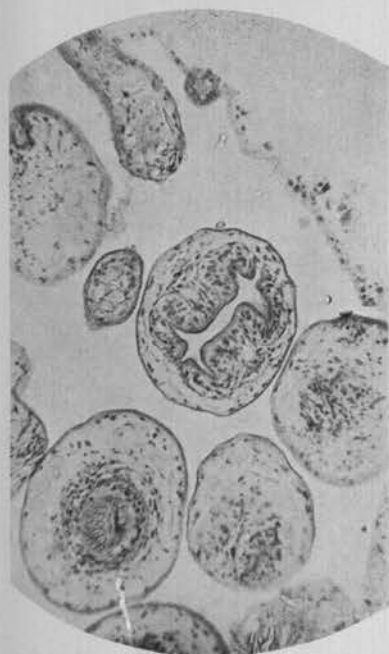
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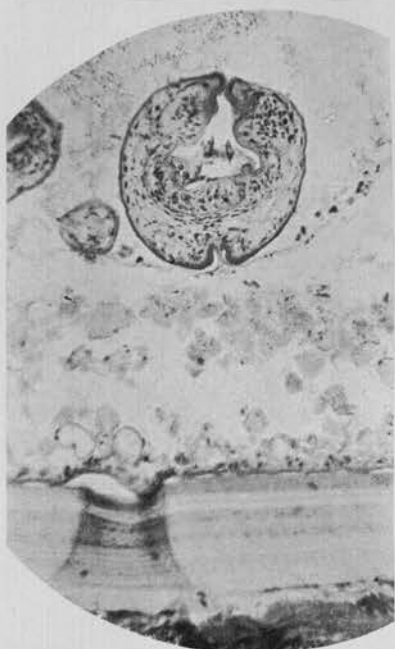
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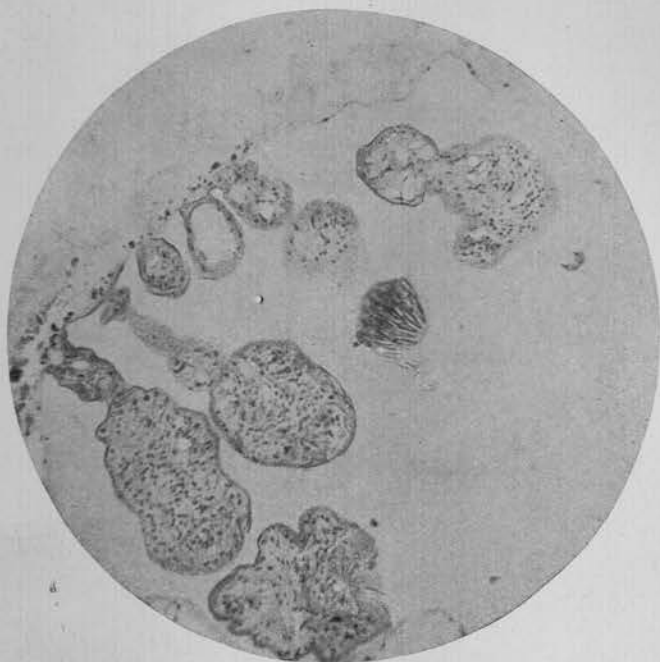
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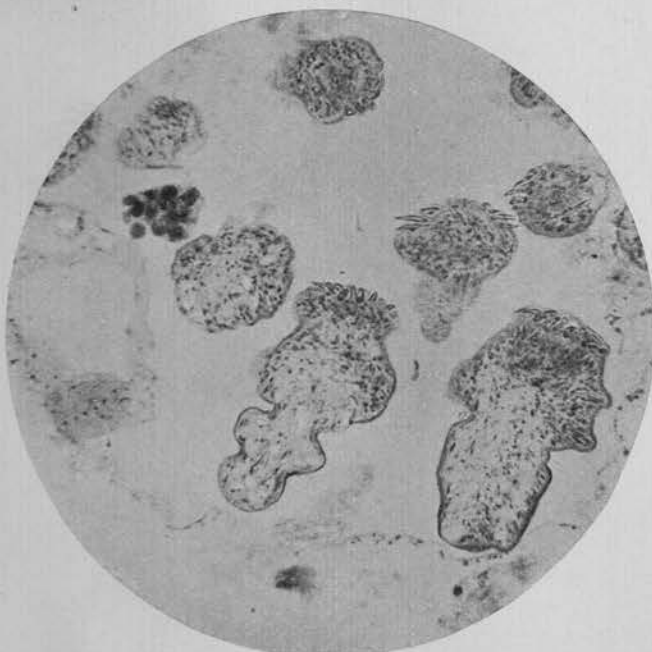
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29



30



31

CURCULIONIDES NOUVEAUX DES PHILIPPINES ET L'ORIENT

Par A. HUSTACHE¹

Of Lagny (Seine et Marne), France

Orchestes anoploideus sp. nov.

Ovale, très convexe, noir brun, les antennes et les tarses testacés, revêtu d'une fine pubescence couchée grise, peu serrée, un peu plus longue et plus blanche en dessous, l'écusson petit, en demi-ovale, cendré.

Rostre épais, subcylindrique, un peu amincé en avant, plus court que le prothorax, presque droit, rugueux, finement sétosulé, ferrugineux et lisse seulement au sommet. Antennes fines, médianes, le scape plus clair, le funicule de 6 articles, le 1^{er} obconique et peu allongé, le 2^e oblong, les suivants courts, serrés, ne croissant que très peu en épaisseur, la massue oblongue, articulée, foncée, pubescente. Yeux grands, peu convexes, séparés en dessus par une étroite ligne de pubescence. Tête conique, courte, densément ponctuée et pubescente. Prothorax petit, plus du double aussi large que long, la base fortement arquée et presque du double aussi large que le bord antérieur, les côtés arqués rétrécés de la base au sommet, convexe, densément et assez grossièrement ponctué rugueux, pubescent. Elytres ovales, séparément arrondis au sommet, le calus huméral un peu élevé, les épaules obtusément arrondies, convexes, brièvement déprimés le long de la base, les stries larges, ponctuées et pubescentes, les interstries plus larges que les stries, convexes, rugueux et pubescentes. Pattes courtes, ponctuées et pubescentes; fémurs inermes, les postérieurs fortement renflés; tibias courts, les postérieurs carénés sur leur tranche externe, leurs corbeilles tarsales très obliques, ascendants, leurs soies jaunes; tarses courts, les ongles appendiculés. Dessous à ponctuation serrée, plus fine sur l'abdomen, métasternum marqué sur son bord pos-

¹ Les espèces décrites, sauf indication contraire, font partie de la collection de M. C. F. Baker et de la mienne.

térieur de trois fossettes, la médiane plus petite et ronde. Longueur, 2.2 millimètres.

Singapore (*Baker*).

Cette espèce a tout le fasciés d'un *Anoplus*.

Nanophyes griseus sp. nov.

Noir, le scape antennaire et les trochanters testacés revêtu d'une dense pubescence appliquée, courte et grise en dessus, plus longue et plus blanche en dessous, seulement un peu plus serrée, sur les côtes de la poitrine mais ne formant pas de tache distincte; les élytres ornés d'une grande tache basale triangulaire de pubescence brun foncé.

Rostre aussi long que la tête et le prothorax, presque droit, fortement pluristrié caréné et ponctué à la base, lisse et pointillé seulement vers le sommet. Antennes médianes, robustes, le funicule a pubescence cendrée, dense et un peu hérissée, de cinq articles, les deux premiers un peu allongés, égaux, le 1^{er} testacé, les 3^e, 4^e, 5^e graduellement un peu plus épais et courts, la massue plus longue que le reste du funicule, son 1^{er} article court, conique, contigu au 5^e article, le 2^e ovale oblong, mieux détaché, le 3^e oblong fusiforme et beaucoup plus long que les deux précédents ensemble. Tête a pubescence cendrée, serrée autour des yeux. Prothorax trapézoïdal, du double aussi large que long, la base fortement et régulièrement arquée, plus du triple aussi large que le bord antérieur; régulièrement convexe en dessus, très légèrement impressionné latéralement dans les angles antérieurs, la ponctuation et la pubescence très serrées, fines. Elytres ovales triangulaires, plus longs que larges, le calus huméral effacé; convexes, visiblement impressionnés transversalement derrière le bord antérieur, les stries très fines, peu visibles, voilées par la pubescence, les interstries plans. Pattes robustes et densément pubescentes de cendré; fémurs fortement renflés et munis de quatre épines, l'interne la plus longue; tibias arqués; tarses bruns, angles sondés à la base. Longueur, 2.8 millimètres.

Singapore (*Baker*).

Nanophyes fulvipes sp. nov.

Brun noir, les pattes (genoux, sommet des articles des tarses, ongles foncés exceptés), le scape antennaire d'un jaune rouge, revêtu d'une pubescence cendrée appliquée, en dessus très courte, formant une fascie oblique et médiane sur les élytres, en dessous

plus longue, blanche et tres serrée, formant tache sur les côtés de la poitrine.

Rostre aussi long que la tête et le prothorax, épais, assez arqué, pourvu à la base de trois sillons peu profonds et de trois carènes obtuses, lisse en avant. Antennes insérées un peu en avant du milieu du rostre, le funicule de cinq articles, le 1^{er} brun, oblong, presque aussi long que les deux suivants réunis, les articles 2-5 courts, serrés, transversaux, la massue grosse plus longue que le reste du funicule, ses articles bien détachés, les deux premiers globuleux. Prothorax trapézoïdal, plus du double aussi large que long, la base modérément arquée; convexe, la ponctuation et la pubescence très fines et peu serrées, le bord antérieur étroitement roux. Elytres plus longs que larges, modérément rétrécis en arrière; convexes, obliquement déclives derrière la base, cette dernière finement rebordée, les stries assez fortes et visiblement ponctuées, les interstries subplans, le bord apical étroitement roux. Pattes à pubescence cendrée, les fémurs armés d'une seule épine fine et assez longue; ongles sondés à la base. Longueur, 1.8 millimètres.

Singapore (*Baker*).

Nanophyes insularis sp. nov.

Ferrugineux, le funicule des antennes noirâtre, revêtu d'une courte pubescence claire, peu serrée, ne violant pas le fond brillant des téguments, les côtés de la poitrine revêtus d'une pubescence blanche, longue et serrée.

Rostre épais, peu arqué, aussi long que la tête et le prothorax, tricaréné à la base, lisse, pointillé et brillant en avant. Antennes à scape ferrugineux atteignant juste la base de l'oeil, le funicule foncé formé de cinq articles, le 1^{er} oblong et du double aussi long que large, le 2^e moins épais, que le 1^{er}, subconique et aussi long que large, les trois suivants serrés, courts, grossissant un peu, la massue brusque, grosse, plus longue que le reste du funicule, ses articles bien séparés, les deux premiers subsphériques. Prothorax trapézoïdal, plus court que large, à ponctuation fine et espacée. Elytres plus longs que larges, modérément rétrécis en arrière, la base brièvement relevée et étroitement marginée de brun, le calus huméral saillant, les stries fines, les interstries subconvexes et finement pointillés, la pubescence dorsale formant une fascie oblique, médiane, remontant vers les épaules, peu nette. Fémurs armés d'une seule épine, fine

et assez longue. Angles noirâtres, sondes à la base. Longueur, 1.8 millimètres.

Luzon, Los Baños (*Baker*).

Nanophyes bakeri sp. nov.

Noir brun, les antennes, massue exceptée et les trochanters testacés, la base des fémurs, les tibias et les tarsi ferrugineux, revêtu d'une pubescence assez longue, couchée, cendrée et assez dense, les côtés de la poitrine couverts d'une longue et dense pubescence squamuleuse blanche.

Rostre mince, peu arque, plus long que la tête et le prothorax, tricaréné à la base, pointillé en avant. Antennes assez allongées, le funicule de cinq articles, les deux premiers allongés, subégaux, le 3^e un peu plus court que le 2^e, les 4^e et 5^e ovoïdes, plus courts et plus épais, la massue oblongue fusiforme, ses articles contigus, non détachés, les deux premiers coniques. Prothorax plus du double aussi large que long, les côtés presque rectilignes et fortement convergents en avant, la base faiblement arquée; convexe, visiblement quoique peu profondément impressionné transversalement en avant, la ponctuation fine et assez serrée, la pubescence dense. Elytres plus longs que larges, modérément rétrécis en arrière, le calus huméral petit, les stries très fines, les interstries très plans et densément pointillés, la pubescence dense. Pattes à pubescence longue et assez dense; fémurs fortement renflés, armés de quatre épines robustes, l'interne longue, les autres graduellement plus courtes; ongles sondés. Dessous à pubescence espacée dans le milieu, serrée autour des hanches antérieures et sur le bord des deux premiers segments ventraux, très serrée, blanche, sur les bords de la poitrine. Longueur, 2.7 millimètres.

Mindanao, Surigao (*Baker*).

Nanophyes bellus nom. nov.

Nanophyes testaceicornis HELLER, nom. praeocc.

Brun, le prothorax et le rostre roux, les pattes et les antennes testacées, les fémurs parfois rembrunis en dessus, revêtu en dessus d'une dense et assez longue pubescence d'un gris jaunâtre, les élytres ornés d'un fascie dénudée postbasale, dentelée, assez large, le dessous revêtu d'une pubescence plus longue cendrée, assez serrée, plus serrée sur les bords de la poitrine. Rostre plus long que la tête et le prothorax, droit et pourvu à la base de plusieurs fines carènes (mâle), arqué et simplement ponctué (femelle), lisse et brillant au sommet, pubescent. An-

tennes médianes, le funicule de cinq articles, les deux premiers égaux et allongés, les suivants globuleux et graduellement plus épais, la massue oblongue, ses articles médiocrement séparés; son 1^{er} article conique et aussi large que long. Prothorax trapézoïdal, transversal, ses côtés rectilignes; convexe, sa ponctuation très fine et serrée, sa pubescence dense, orné de chaque côté d'une petite tache médiane de pubescence plus claire. Elytres très convexes, les stries fines, les interstries un peu convexes, plus fortement vers le sommet. Fémurs fortement renflés, armés de cinq épines, l'interne longue; ongles sondés à la base. Longueur, 2.3 millimètres.

Luzon, Province de Zambales (*Baker*).

Nanophyes ligatus Heller (in litt.).

Grand, noir, peu brillant, le scape ferrugineux, les premiers articles du funicule d'un brun ferrugineux, orné en dessus d'un dessin blanc tranché, formé de poils squamuleux serrés, comprenant sur le prothorax une bande basale sur les ongles postérieurs, prolongée en dessous, une macule oblongue sur le tiers antérieur du 2^e interstrie, une bande transversale sur les élytres, un peu au de là de leur milieu, cette bande interrompue à la suture, droite, s'effaçant graduellement à partir du 6^e interstrie; les points des stries sont pourvus de fins poils blancs bien visibles en avant jusqu'à la bande transversale, en arrière de cette bande les stries et les interstries latéraux sont assez densément pubescents, enfin on distingue une petite macule sur le milieu de la base du prothorax et de nombreux poils dans ses angles antérieurs. Dessous revêtu de poils plus grossiers, blancs, longs, assez serrés, très serrés et formant tache sur les côtés de la poitrine et devant les hanches antérieures.

Rostre mince, plus long que la tête et le prothorax, finement ponctué en série à la base (femelle), ou plus court, plus épais, pourvu de cinq carènes et d'autant de sillons à la base, hérissé de courtes soies blanches, droit (mâle). Antennes insérées vers le milieu (femelle) ou le tiers antérieur (mâle) du rostre, le scape atteignant (femelle) ou dépassant (mâle) le bord antérieur de l'œil; funicule de cinq articles, femelle les deux premiers allongés, le 2^e un peu plus long que le 1^{er}, les trois suivants oblongs, beaucoup plus longs que larges, les trois articles de la massue bien séparés, gros, le 1^{er} obconique, le 2^e subtransversal, le mâle tous les articles plus courts et plus épais. Prothorax transversal, les côtés un peu arqués en arrière, plus fortement, sinués en avant, la base peu arquée; convexe, très finement ponctué coriacé. Elytres

finement rebordés à la base, les stries fines, les interstries finement ponctués-coriacés et munis en arrière de quelques longs poils blancs verticaux. Pattes pubescentes de cendré, les fémurs fortement renflés et munis de quatre épines, plus fortes chez le mâle; ongles sondés à la base. Pygidium à pubescence très fine et peu serrée. Longueur, 3.1 à 3.3 millimètres.

Singapore (*Baker*).

Nanophyes fulvoapicalis sp. nov.

Mâle.—Noir, assez brillant, les antennes et les tarses ferrugineux, les trochanters testacés, le tiers apical des élytres revêtu d'une dense pubescence jaunâtre, orné en outre de deux fascies transversales de poils blancs, l'une sur le milieu du prothorax prolongée en arrière ou milieu par une linéole jusque sur la base, l'autre un peu en arrière de la base des élytres, sinueuse, remontant presque à la base du 5^e interstrie, élargie et prolongée en arrière sur les deux premiers interstries; l'abdomen revêtu d'une fine pubescence cendrée, les côtés de la poitrine d'une pubescence squamuleuse blanche très serrée (entremêlée de quelques poils jaunes) formant tache, une tache semblable sur les hanches antérieures, les côtés du prothorax grossièrement ponctués et couverts de longs poils blancs et jaunâtres.

Rostre épais, peu arqué, aussi long que la tête et le prothorax, muni à la base de cinq carènes et d'autant de sillons ponctués, fins, le sommet brun brillant, sérialelement ponctué et pourvu d'un sillon latéral ponctué, n'atteignant pas tout à fait le sommet. Antennes robustes, le funicule de cinq articles, les deux premiers peu allongés et égaux, les suivants serrés, graduellement plus épais, la massue oblongue, ses articles à peine séparés. Yeux entourés de cils blancs. Prothorax trapézoïdal, transversal, à ponctuation fine. Elytres nettement rebordés à la base, transversalement assez largement et profondément impressionnés derrière ce rebord, les stries fines, les latérales visiblement ponctuées dans leur milieu, les interstries pointillés coriacés. Pattes pubescentes de cendré, les fémurs fortement renflés et munis de quatre épines; ongles parallèles et sondés à la base. Longueur, 2.6 millimètres.

Singapore (*Baker*).

Pseniclea violacea (Heller).

Nanophyes violacea Heller.

Glabre, brillant, rouge ferrugineux, les élytres violets leur tiers apical rouge.

Rostre à peine aussi long que le prothorax, peu arqué, comprime latéralement à la base, aminci graduellement en avant, en dessus lisse, très finement et éparsément pointillé. Antennes médianes, le 1^{er} article du funicule gros, obconique, assez allongé, les articles suivants très minces, la massue grosse oblongue, aussi longue que le reste du funicule. Tête à ponctuation fine, plus forte et très serrée derrière les yeux, ces derniers contigus en arrière. Prothorax trapézoïdal, une fois et demie aussi large que long, la base bisinuée de chaque côté; convexe, à ponctuation fine et espacée. Ecusson petit et arrondi. Elytres très convexes, triangulaires, plus longs que larges, arrondis ensemble au sommet, le calus huméral grand mais peu élevé, munis chacun de 10 rangs de points ronds, peu serrés, médiocres, effacés en arrière, les 8^e et 9^e rangs effacés en avant vers le calus huméral, le 10^e à points grands, profonds, serrés, creusé en sillon en avant, le bord latéral subcaréné. Pattes courtes et robustes; fémurs canaliculés, fortement dentés, rugueux, les points pourvus d'une courte soie squamuleuse claire; tibias fortement arqués à la base, rugueux subsillonnés; tarses courts, le 1^{er} article une fois et demie aussi long que large. Dessous: côtés du prothorax à ponctuation forte et espacée; métasternum rugueux et finement pubescent au milieu, les bords pourvus de gros points espacés; quatre derniers segments abdominaux lisses et glabres, brillants. Longueur, 2,3 à 2,5 millimètres.

Luzon, Mount Maquiling, Mount Banahao (*Baker*).

Pseniclea castanea sp. nov.

Brun rouge, brillant, les fémurs un peu assombris. Forme de l'espèce précédente dont elle diffère en outre de la coloration par les caractères suivants: Points des séries élytrales plus fins, la 9^e série complète, atteignant la base, la 10^e à points moins forts, moins creusée en avant; bords de la poitrine pourvus d'un plus grand nombre de points; antennes plus grêles, le 1^{er} article de funicule plus long. Longueur, 2,3 à 2,5 millimètres.

Mindanao, Iligan, Dapitan (*Baker*).

Idotasia bakeri sp. nov.

Brun rouge, brillant, le prothorax brun noir, les élytres d'un rouge brun clair, les élytres pourvus le long de la base et vers le sommet de quelques grosses squamules jaunâtres, les points du prothorax et des pattes pourvus chacun d'une courte soie squamuleuse jaunâtre, les segments abdominaux munis d'une frange de poils squamuleux jaunâtres assez longs et serrés.

Rostre large, aussi long que le prothorax, ses bords sinués, dilaté latéralement un peu en avant de la base, pourvu de cinq fortes carènes, la médiane droite, entière et la plus élevée, l'externe courte et sinuée, ces carènes séparées par des sillons ponctués, densément squamulés et setosulés. Tête très lisse, imponctuée. Prothorax subconique, aussi long que large à la base, les côtés à peine arqués, la base subrectiligne et du double aussi large que le bord antérieur; convexe, couvert de grands points profonds serrés, très serrés et rugueux en avant, moins gros et moins serrés vers la base, le milieu avec une courte carène obtuse et imponctuée. Elytres ovoïdes, beaucoup plus larges que le prothorax, une fois et un quart aussi longs que larges ensemble, brusquement rétrécis mais peu prolongés vers le sommet; très convexes, leur courbure dorsale continuant celle du prothorax, munis de séries de points fins et très finement squamulés au fond, grossièrement ponctués le long de la base et surtout au sommet, les interstries lisses, le 1^{er} pointillé en avant. Fémurs linéaires, grossièrement ponctués, profondément canaliculés, inermes; tibias carénés, les postérieurs dilatés au milieu de leur bord interne en une large lame triangulaire; soies des corbeilles tarsales et des tarse jaunes. Segment anal pourvu de deux grandes fossettes contigues, males, limitées en arrière par une forte touffe de poils jaunes. Longueur, 3.5 millimètres.

Luzon, Mount Maquililing (*Baker*).

Idotasia semirubra sp. nov.

Forme générale et coloration de l'espèce précédente, mais les élytres ornés chacun de deux petites taches squamuleuses blanches, l'une sur la base du 4^e interstrie, l'autre vers le sommet près du bord latéral, munis en outre de quelques grosses squamules blanches le long du 2^e interstrie et vers le sommet.

Rostre comme chez l'espèce précédente, mais toutes les carènes courtes atteignant seulement le milieu, ponctué et lisse en avant. Tête lisse. Prothorax faiblement conique, aussi long que large, a ponctuation fine et très espacée, muni de chaque côté derrière le bord antérieur d'un profond sillon oblique n'atteignant pas le milieu. Elytres non ponctués le long de la base, les points des séries très fins sur le disque, devenant gros et serrés vers le sommet, ceux de la 7^e série grossière et serrés sous l'épaule. Tibias postérieurs non dilatés en dedans. Abdomen muni seulement de quelques grosses squamules sur le bord des segments,

les deux premiers segments et le 5° très profondément excavés, glabres et brillants. Longueur, 2,5 millimètres.

Sibuyan (*Baker*).

Lobotrachelus bakeri sp. nov.

Brun noir, les antennes et les tarses testacés, revêtu sur les pattes et en dessous d'une pubescence grossière, squamuleuse, cendrée et serrée, plus grossière et plus serrée sur les bords du prosternum, le dessus à pubescence foncée, peu visible, et orné d'un dessin formé de poils squamuleux d'un blanc jaunâtre couvrant la suture en entier (les poils dirigés obliquement en arrière), formant une courte linéole sur la base des 2° et 3° interstries, une bande sur la base du prothorax (interrompue devant le lobe scutellaire); quelques poils plus fins se voient encore sur le bord antérieur du prothorax et sur la marge apicale des élytres, cette dernière est étroitement ferrugineux.

Rostre aussi long que les fémurs antérieurs, d'un brun noir, pointillé et très éparsément pubescent à la base, lisse et roussâtre au sommet. Yeux séparés par une ligne de pubescence. Antennes assez épaisses, le 2° article plus court et beaucoup moins épais que le 1^{er}, un peu plus long que le 3°. Prothorax trapézoïdal, du double aussi large que long, convexe, la ponctuation très serrée mais peu profonde. Lobe scutellaire obtus. Elytres triangulaires, peu plus longs que larges ensemble, les stries profondes et ponctuées, les interstries plans, finement ponctués, brillants entre les points. Fémurs inermes, non canaliculés en dessous. Longueur, 2,5 millimètres.

Mâle.—Premier segment ventral déprimé, le segment anal pourvu d'une petite fossette dénudée. Bords de la poitrine couverts de véritables squamules ovales.

Mindanao, Dapitan (*Baker*).

Lobotrachelus minutus sp. nov.

Noir, les antennes et les tarses testacés, revêtu en dessus d'une fine pubescence cendrée, uniformément répartie (plus grossière et plus serrée sur le lobe scutellaire), le dessous et les pattes couverts d'une pubescence squamuleuse grossière blanchâtre, encore plus dense et plus blanche sur les bords de la poitrine et du prosternum.

Rostre roux au sommet, densément squamulé de blanc et assez épais (mâle), ou mince, pourvu seulement de quelques fins poils et de points petits et épars (femelle). Yeux séparés par une ligne

de pubescence. Antennes longues et filiformes, le 1^{er} article du funicule très long, aussi long que les trois suivants réunis, le 2^e allongé mais plus court que le 1^{er}, la massue étroite, funiforme. Prothorax trapézoïdal, une fois et demie aussi large que long; convexe, légèrement impressionné à la base, de chaque côté du lobe scutellaire, la ponctuation forte et serrée, les points légèrement ocellés émettant chacun un poil couché dirigé en avant, les intervalles entre les points rugueux. Elytres triangulaires, le bord apical ferrugineux, les stries fines et pourvues d'un rang de poils plus courts et plus fine que ceux des interstries, les poils des interstries légèrement soulevés, disposés en avant sur deux rangs et en arrière sur un seul rang. Fémurs canaliculés et finement dentés en dessous.

Mâle.—Segment anal pourvu d'une grande et profonde fossette densément squamulée sur son bord antérieur (les squamules petites et laciniées), glabre et rugueuse en arrière. Longueur, 1.5 millimètres.

Mindanao, Bukidnon, Tangkulan (*Baker*).

Lobotrachelus suturalis sp. nov.

Mâle.—Noir, les antennes et les tarses testacés, le bord apical des élytres ferrugineux, revêtu sur le rostre, les côtés de la poitrine, du prosternum d'une couche de squamules blanches de neige, sur les pattes et l'abdomen de poils squamuleux grossiers et cendrés, le dessus revêtu de poils foncés et fins et ornés d'un dessin blanc formé sur les élytres de poils allongés, sur le prothorax de poils plus courts, assez serrés, laissant une grande tache médiane dénudée, le dessin élytral comprenant une linéole suturale, une courte linéole (formée de deux lignes de poils peu serrés) sur la base des interstries 2 à 7, une linéole sur le milieu des 2^e et 3^e interstries.

Antennes moyennement épaisses, le 1^{er} article du funicule beaucoup plus épais que le 2^e, plus long que les 2^e et 3^e réunis, le 2^e peu plus long que large et à peine plus long que le 3^e, la massue oblongue. Prothorax trapézoïdal, du double aussi large que long, légèrement déprimé à la base de chaque côté du lobe scutellaire, ce dernier densément pubescent, la ponctuation très serrée, légèrement ocellée, les poils couchés, plus grossiers, squamuleux le long de la base. Elytres triangulaires, à peine plus longs que larges, les stries fortes, les interstries ponctués et rugueux. Fémurs finement dentés et canaliculés à la base; 1^{er} article des tarses plus long que les deux suivants réunis. Seg-

ment anal pourvu d'une fine carène médiane. Longueur, 2,3 millimètres.

Luzon, Mount Maquiling (*Baker*).

Lobotrachelus elongatulus sp. nov.

Mâle.—Rhomboidal, allongé, noir, les antennes et les tarses testacés, le bord apical des élytres étroitement ferrugineux, revêtu en dessus d'une pubescence blanche, alignée sur les interstries, serrée sur la suture, plus grossière et très serrée, squamuleuse sur le bord postérieur du prothorax et le lobe scutellaire, revêtu en dessous de squamules blanches très serrées sur les bords de la poitrine, du prothorax, sur le rostre, linéaires, fines sur les pattes.

Rostre court, beaucoup plus court que les fémurs antérieurs, roux au sommet, densément blanc. Antennes assez courtes, le 2^e article beaucoup plus court et moins épais que le 1^{er}. Prothorax seulement un peu plus large que long, les côtés légèrement arqués, convexe, la ponctuation très serrée, rugueuse, la pubescence fine et régulièrement répartie sauf le long de la base. Elytres étroits, à peine plus larges que le prothorax, presque du double aussi longs que larges ensemble, les stries larges, profondes, glabres, les interstries convexes pourvus en avant de deux rangs, en arrière d'un seul rang de poils. Fémurs obsolètement dentés. Segment anal pourvu d'une très grande fossette glabre, brillante et pointillée. Longueur, 2,2 millimètres.

Borneo, Sandakan (*Baker*).

Lobotrachelus luteofasciatus sp. nov.

Noir, les antennes ferrugineuses, les tarses bruns, orné en dessus d'un dessin jaune formé de poils squamuleuse épais, comprenant deux bandes transversales sur le prothorax, l'une sur le bord antérieur, l'autre sur la base, celle-ci dilatée légèrement au milieu, trois fascies transversales sur les élytres, la 1^{er} basale formé de linéoles inégales, la 2^e médiane, large, arquée en avant au milieu; prolongée en avant par une linéole sur le 8^e interstrie, reliée en arrière à la 3^e fascie sur les interstries 6, 7, 8, la 3^e fascie apicale, le lobe scutellaire et la suture entièrement jaunes; revêtu en dessous d'une pubescence squamuleuse, jaune sur les bords, d'un gris jaunâtre sur le milieu.

Rostre court, très épais, grossièrement ponctué, fortement caréné à la base, à pubescence très éparsée et fine (mâle, femelle). Deux premiers articles du funicule peu allongés, le 1^{er} plus gros

et plus long que le 2^e, les suivants globuleux. Prothorax trapézoïdal, du double aussi long que large, convexe, brillant, la ponctuation fine et espacée. Lobe scutellaire allongée et aigu, entouré d'un profond sillon glabre. Stries élytrales larges, profondes, ponctuées, les interstries convexes, densément ponctués rugueux. Pattes à pubescence très fine, presque glabres; fémurs densément ponctués-striés, profondément canaliculés en dessous, inermes, tibias droits. Mâle, métasternum et 1^{er} segment ventral déprimés. Longueur, 3.5 à 3.7 millimètres.

Himalaya Oriental (*R. P. Bertrand*), ma collection.

Lobotrachelus himalayanus sp. nov.

Noir, brillant, les antennes ferrugineuses, les tarses bruns, orné en dessus d'un dessin blanc formé de poils fins, comprenant une courte linéole sur le lobe scutellaire, la base de la suture et du 3^e interstrie, une courte linéole sur le milieu de la suture et des interstries 2, 3, 4, 5, une courte linéole sur le sommet de la suture, dessous revêtu de poils squamuleux grisâtres, les côtés de la poitrine et une étroite bande dans l'angle du prothorax et des élytres à squamules blanches et très serrées.

Rostre comme chez l'espèce précédente. Deux premiers articles du funicule assez allongés, les suivants graduellement épaissies. Prothorax conique, presque aussi long que large, légèrement étranglé latéralement en avant, à ponctuation fine et espacée. Elytres déprimés autour de l'écusson, les stries larges et profondes, les interstries plans, à peine pointillés. Pattes à ponctuation espacée, les points pourvus de poils squamuleux courts et cendrés; fémurs finement dentés, brièvement sillonnés au sommet. Longueur, 2.7 à 3 millimètres.

Himalaya Oriental (*Bertrand*), ma collection.

Lobotrachelus bertrandi sp. nov.

Mâle.—Noir, presque mat, les antennes testacées, densément revêtu en dessous et sur le rostre de squamules oblongues, blanches, linéaires sur les pattes, orné sur le prothorax d'une fascie apicale, interrompue au milieu et d'une bande basale cendrées, sur les élytres d'une fascie basale étroite prolongée sur la suture presque jusqu'au sommet, cendrées; écusson arrondi et cendré, entouré d'un sillon dénudé; lobe scutellaire presque dénudé.

Rostre assez long. Deux premiers articles du funicule allongés, le 1^{er} le plus long. Prothorax trapézoïdal, presque du double aussi large que long, convexe, à ponctuation peu profonde

mais assez grande et très serrée, rugueuse. Elytres peu rétrécis en arrière, le calus huméral saillant, brillant; convexes, déprimés autour de l'écusson, les stries profondes et ponctuées, les interstries subconvexes, rugueux, revêtus d'une très courte pubescence d'un brun foncé. Pattes élancées, les fémurs sillonnés et dentés. Segment anal pourvu d'une grande fossette dénudée. Longueur, 3.2 millimètres.

Himalaya Oriental (*Bertrand*), ma collection.

Lobotrachelus pusillus sp. nov.

Noir, presque mat, les antennes testacées, les tarses et les quatre tibias antérieurs ferrugineux, revêtu en dessus d'une fine pubescence d'un brun fonce, peu visible et de quelques poils fins et gris sur la base des interstries et la suture, revêtu en dessous de squamules blanches serrées, plus serrées sur les bords.

Rostre glabre et éparsément pointille (femelle), ou plus épais et densément squamulé (mâle). Premier article du funicule épais et aussi long que les 2^e et 3^e réunis, le 2^e court et peu plus long que le 3^e. Prothorax conique, peu plus large que long; modérément convexe, la ponctuation serrée et ruguleuse. Elytres triangulaires, plus longs que larges, le calus huméral saillant, les stries profondes, les interstries plans et rugueux; lobe scutellaire densément pubescent de cendré. Pattes grêles; fémurs ponctués et finement squamulés, finement dentés, obsolètement canaliculés, tibias grêles et pubescents. Longueur, 1.7 millimètres.

Himalaya Oriental (*Bertrand*), ma collection.

Lobotrachelus parvulus sp. nov.

Mâle.—Noir, les antennes, les tibias antérieurs et les tarses testacés, uniformément revêtu en dessus de poils fins et cendrés, disposés en deux rangs peu réguliers sur chaque interstrie, serrés sur le lobe scutellaire, couvert en dessous de poils squamuleux et blanchâtres, blancs et très serrés sur le rostre les bords de la poitrine et du prothorax. Prothorax conique, presque aussi long que large, convexe, la ponctuation très fine et très serrée, peu profonde, ruguleuse. Elytres peu plus larges que le prothorax, assez allongés, le calus huméral saillant, les stries larges, munies d'un rang de poils très courts, plus courts et plus fins que ceux des interstries, les interstries plans et à peine plus larges que les stries. Pattes linéaires, grêles, pubescentes de cendré, les fémurs canaliculés et inermes, le 1^{er}

article des tarses plus long que les trois suivants réunis. Longueur, 1.7 millimètres.

Java, ma collection.

Lobotrachelus pectoralis sp. nov.

Mâle.—Noir, brillant, les antennes et les tarses testacés, revêtu en dessus de fines soies squamuleuses couchées cendrées, obliquement dirigées sur la suture, en deux séries régulières sur chaque interstrie, plus courtes et régulièrement réparties sur le prothorax, serrées sur le lobe scutellaire, revêtu en dessous de squamules oblongues d'un blanc de neige, serrées, très serrées, sur le rostre les côtés de la poitrine et du prothorax.

Antennes assez grêles, le 1^{er} article du funicule plus long que les 2^e et 3^e réunis. Prothorax trapézoïdal, plus large que long, légèrement impressionné latéralement en avant, la ponctuation ocellée, mais fine, superficielle et très serrée. Elytres triangulaires, fortement rétrécis en arrière, le calus huméral en forme de ligne élevée lisse et brillante, les sillons larges, profonds et glabres, les interstries peu plus larges que les sillons, plans, brillants, bisérialement ponctués et sétosulés. Fémurs linéaires, rugueux, sétosules, inermes; tibias à pubescence cendrée assez longue. Segment anal occupé par une grande fossette, profonde, ronde, glabre, brillante, pointillée. Longueur, 2.4 millimètres.

Tonkin, Hoa Binh (ma collection).

Lobotrachelus affinis sp. nov.

Noir, les antennes et les tarses testacés, le bord apical des élytres ferrugineux, revêtu en dessous de squamules allongées blanches, plus serrées sur le rostre et les côtés du prothorax et de la poitrine, revêtu en dessus d'une très courte pubescence d'une brun foncé, et de poils cendrés formant sur les élytres deux fascies légères, l'une basale et large, l'autre médiane raccourcie à ses extrémités, la suture presque entièrement pubescente, le lobe scutellaire blanc, la pubescence régulièrement répartie sur le prothorax mais laissant devant le lobe scutellaire une grande tache dénudée.

Rostre fortement caréné, roux au sommet. Premier article du funicule antennaire aussi long que les 2^e et 3^e ensemble. Prothorax trapézoïdal, du double aussi large que long, convexe, à ponctuation fine et serrée. Elytres ovales triangulaires, peu plus longs que larges ensemble, le calus huméral saillant, les sillons profonds, les interstries rugueux. Pattes allongées,

squamulées; fémurs canaliculés et armés d'une épine assez longue; 1^{er} article des tarses plus long que les trois suivants ensemble. Longueur, 1.7 millimeters.

Cochinchine, Tay-Ninh (ma collection).

Lobotrachelus rufirostris sp. nov.

Femelle.—Noir, les antennes testacées, le rostre rouge, les pattes ferrugineux, revêtu en dessus de poils cendrés, assez raides, alignés, revêtu en dessous de squamules blanches, plus serrées sur les côtés de la poitrine et du prothorax.

Rostre mince, cylindrique, glabre, plus long que le prothorax. Antennes minces, les deux premiers articles allongés, le 1^{er} aussi long que les 2^e et 3^e réunis. Prothorax conique, presque aussi long que large, à ponctuation superficielle, assez grande, visiblement ocellée et serrée. Elytres triangulaires, fortement rétrécis en arrière, beaucoup plus longs que larges, le calus huméral élevé, en forme de ligne saillante et lisse, les stries ponctuées, les interstries plans, rugueux, leurs poils alignés sur deux rangs en avant, un seul en arrière, le bord apical ferrugineux. Pattes squamulées de cendré, les fémurs armés d'une forte dent; tibias dilatés vers leur sommet; 1^{er} article des tarses plus court que les trois suivants ensemble. Longueur, 2.5 millimètres.

Cochinchine, Tay-Ninh (ma collection).

Semiathe cribricollis sp. nov.

Rouge ferrugineux, le prothorax un peu plus foncé, peu brillant, revêtu en dessus de grosses squamules lancéolées, éparses le long des interstries, serrées et formant une macule allongée sur la base du 3^e interstrie, d'un blanc jaunâtre, les pattes et les points du dessous pourvus de soies squamuleuses très courtes.

Rostre plus court que le prothorax, ponctué rugueux, subcaréné et sétulosé seulement à la base, rétréci, lisse et brillant en avant. Antennes courtes, la massue ovale et foncée. Tête rugueusement ponctuée et sétulosée. Prothorax trapézoïdal, plus large que long, les côtés à peine arqués, la base bisinuée, couvert de points ocellés, très serrés, confluent en rides en avant. Ecusson petit. Elytres ovales triangulaires, plus longs que larges, faiblement comprimés latéralement vers le sommet, les stries fortes et profondes, les interstries plans ponctués rugueux, plus fortement rugueux, convexes et mats vers le sommet. Pattes rugueuses; fémurs linéaires canaliculés seulement à leur base, assez fortement dentés; tibias finement carénés, les antérieurs visiblement arqués. Dessous à ponctuation assez ser-

rée, forte, plus fine et très serrée sur le segment anal, unisériée sur les 3^e et 4^e segments ventraux. Longueur, 2.7 millimètres. Luzon, Mount Maquiling (*Baker*).

Chez cette espèce les yeux ont de fines facettes, les élytres les épaules nulles, le prothorax un lobe basal obtus, peu avancé.

Genus *TELEPHAE* Pascoe²

1. Côtés du prothorax pourvus soit d'un tubercule, soit d'une tache squamuleuse qui en tient lieu..... 2.
Côtés du prothorax depourvus de tubercule ou de tache squamuleuse spéciale..... 10.
2. Prosternum muni de deux tubercules ou d'une lamelle derrière les hanches antérieures..... 3.
Prosternum simple derrière les hanches antérieures..... 5.
3. Tubercule latéral du prothorax saillant, arrondi et corné..... 4.
A même tubercule peu saillant, son bord postérieur très oblique en arrière..... *T. obtusata* sp. nov.
4. Pubescence dorsale jaunâtre formant trois fascies sur les élytres et une grande tache sur les angles postérieurs du prothorax.
T. ornata sp. nov.
- Pubescence dorsale grise, formant deux fascies sur les élytres.
T. griseofasciata sp. nov.
5. Tubercules latéraux du prothorax bien visibles de haut..... 7.
Ces mêmes tubercules visibles seulement de profil ou remplacés par une tache squamuleuse..... 6.
6. Pattes rouges..... *T. minuta* sp. nov.
Pattes foncées..... *T. carinirostris* sp. nov.
7. Tubercules du prothorax saillants, arrondis au sommet..... 8.
Ces mêmes tubercules obtus, plus ou moins allongés..... 9.
8. Pubescence dorsale longue, uniforme, cendré..... *T. grisea* sp. nov.
Pubescence dorsale jaunâtre formant deux fascies sur les élytres.
T. ferruginipes sp. nov.
9. Elytres ornés de nombreuses linéoles jaunes et tranchées.
T. lineolata sp. nov.
- Pubescence élytrale d'un cendré jaunâtre, irrégulière, les linéoles mal définies..... *T. striata* p. nov.
10. Antennes noires..... *T. nigricornis* sp. nov.
Antennes ferrugineuses ou testacées..... 11.
11. Pubescence dorsale d'un beau brun d'ocre formant de nombreuses taches sur le prothorax (10) et sur les élytres..... *T. maculithorax* sp. nov.
Pubescence dorsale cendrée ou jaunâtre..... 12.
12. Elytres ornés de deux fascies cendrées..... *T. pusilla* sp. nov.
Pas de fascie sur les élytres..... *T. neglecta* sp. nov.

Telephae ornata sp. nov.

Noir brun, less tibias ferrugineux, les antennes et les tarses testacées, revêtu en dessous de poils squamuleux jaunâtres,

² Les nombreuses espèces décrites ici pourront être différenciées ainsi.

régulièrement répartis et assez serrés, revêtu en dessus d'une pubescence squamuleuse d'un brun foncé et jaune, cette dernière formant sur le prothorax une grande tache rectangulaire sur les angles postérieurs, une tache allongée, latérale, moins nette, sur les côtés en avant, une étroite ligne médiane n'atteignant pas la base; le dessin jaune est composé sur les élytres de linéoles formant une fascie basale, couvrant le calus huméral en avant mais interrompue sur le 6^e interstrie, d'une fascie ondulée vers le milieu, interrompue sur les 4^e et 6^e interstries et n'atteignant pas les bords latéraux, la linéole suturale placée plus en arrière que les linéoles voisines, enfin une fascie antéapicale droite, entre les cinquièmes interstries; la linéole basale de la suture est longue et en couvre le tiers antérieur.

Rostre brun, ponctué-striolé jusqu'à l'insertion antennaire, ferrugineux et brillant en avant, la carène basale obtus. Antennes courtes, les articles du funicule serrés et graduellement épaissies, la massue grosse, ovale et foncée. Prothorax presque du double aussi large que long, les côtés modérément arqués convergents en avant des tubercules, convexe, la ligne médiane un peu élevée, la ponctuation assez forte et très serrée, les tubercules latéraux saillants, arrondis au sommet et squamulés, jaunes. Ecusson arrondi, densément pubescent, jaune, entouré d'un sillon. Elytres en demi-ovale, le calus huméral large, élevé, jaune en avant, brun en arrière; modérément convexes, légèrement déprimés le long de la base; stries étroites, profondes; interstries larges, plans, leurs soies squamuleuses disposées sur deux ou trois rangs assez réguliers; bord apical étroitement roux et translucide. Pattes pubescentes de jaune. Canal rostral profond, terminé entre les hanches antérieures. Prosternum muni de chaque côté d'un petit tubercule derrière les hanches antérieures.

Longueur, 3.2 à 3.5 millimètres.

Borneo, Sandakan (*Baker*).

Telephae ornata var. *diffusa* var. nov.

Cette variété diffère de la forme typique par le revêtement formé de poils squamuleux bruns et gris jaunâtres; ces derniers remplacent les poils squamuleux jaunes de la forme typique et le dessin qu'elles forment est moins tranché; en outre la massue antennaire est rousse comme le reste des antennes.

Même provenance.

Telephae obtusata sp. nov.

Oblong, brun, les pattes et le rostre ferrugineux, les antennes et les tarses testacées, revêtu d'une fine pubescence couchée

brune et cendrée, la pubescence cendrée formant sur les élytres une large fascie basale, une deuxième fascie postmédiane, une troisième apicale, la suture presque entièrement cendrée.

Rostre ponctué strié latéralement et caréné au milieu à la base, lisse en avant. Tête à peu près glabre, à ponctuation fine et serrée. Prothorax très peu plus court que large à la base, les côtés un peu divergents de la base jusqu'aux tubercules latéraux, puis peu arqués mais assez fortement convergents en avant, la base deux fois et demie aussi large que le bord antérieur, les tubercules latéraux squamulés, médiocrement saillants, leur bord latéral très oblique en arrière, coupé perpendiculairement en avant; convexe, la ligne médiane un peu élevée, la ponctuation très serrée, la pubescence cendrée dirigée transversalement vers la ligne médiane, plus serrée vers les bords et laissant de chaque côté de la ligne médiane une bande presque glabre. Ecusson arrondi, cendré, entouré d'un sillon. Elytres en demi ovale, le calus huméral grand et assez saillant; modérément convexes, légèrement impressionnés autour de l'écusson, les stries profondes, devenant plus étroites en arrière, les interstries larges, plans, finement rugueux; bord apical étroitement roux et translucide. Pattes et dessous revêtus d'une très fine pubescence peu serrée d'un gris flave. Canal rostral profond devant les hanches antérieures; prosternum pourvu d'une lamelle assez élevée, de chaque côte, derrière les hanches antérieures. Longueur, 2.5 millimètres.

Palawan, Puerto Princesa. Singapore (*Baker*).

Telephae griseofasciata sp. nov.

Noir, peu brillant, les antennes et les tarses roux, revêtu d'une fine pubescence brune et cendrée, la pubescence cendrée formant sur les élytres une fascie basale et une fascie médiane remontant en avant à partir de 6^e interstrie, la suture cendrée exceptée avant le milieu; bord apical étroitement ferrugineux.

Rostre ponctué et caréné à la base, lisse, roux, brillant en avant. Prothorax fortement transversal, plus étroit en avant qu'à la base, les tubercules latéraux saillant, arrondis à leur sommet, cornés, cendrés; modérément convexe, la ponctuation forte, serrée, les points légèrement pupillés, la pubescence cendrée, presque nulle au milieu, plus abondante sur les bords, dirigée vers le milieu. Ecusson ovale, cendré, entouré d'un sillon. Elytres en demi ovale, le calus huméral saillant; convexes, obliquement déclives vers la base; stries profondes; interstries larges et plans, finement rugueux. Pattes et dessous à très fine pubescence cen-

drée. Prosternum pourvu d'une lamelle assez élevée de chaque côté, derrière les hanches antérieures. Longueur, 2.2 millimètres.

Borneo, Sandakan (*Baker*).

Telephae carinirostris sp. nov.

Oblong, noir brun, les tarses ferrugineux, les antennes et les tibias testacés, revêtu en dessus d'une pubescence cendrée formant sur les élytres deux fascies, l'une basale, l'autre médiane, la suture pubescente sur la moitié apicale et son tiers antérieur, le 1^{er} interstrie pubescent au sommet.

Rostre muni d'une carène vive jusqu'à l'insertion antennaire, ponctué latéralement à la base, ferrugineux, lisse en avant. Prothorax transversal, les côtés peu arqués dans leur moitié postérieure, assez fortement rétrécis sinués en avant, les angles postérieurs presque droits; modérément convexe, plus fortement le long de la ligne médiane, la ponctuation serrée et un peu rugueuse, les tubercules latéraux remplacés par une tache squamuleuse couvrant le tiers postérieur, la pubescence cendrée fine et éparse, un peu plus serrée dans le milieu et sur les bords. Ecusson arrondi, cendré, entouré d'un sillon. Elytres un peu plus larges que le prothorax, une fois un tiers aussi longs que larges ensemble, les épaules obliques, le calus huméral peu marqué; modérément convexes, obliquement déclives en avant, cette déclivité cendrée, les sillons fins et ponctuels, les interstries plans, finement ponctuels ridés. Pattes et dessous à pubescence cendrée, plus fine sur les pattes; fémurs antérieurs fortement renflés, les tibias antérieurs arqués et leurs bords parallèles. Prosternum concave. Longueur, 2.5 millimètres.

Mindanao, Butuan (*Baker*).

Cette espèce doit être voisine de *T. ursula* Heller mais les élytres sont plus longs, plus parallèles sur les côtés et le dessin est différent.

Telephae minuta sp. nov.

Oblong, noir, les pattes et les antennes d'un rouge jaune, la pubescence cendrée, fine, formant sur les élytres trois fascies, une basale, une postmédiane complète et fortement dentelée, une apicale interrompue sur les 3^e, 6^e, 7^e interstries.

Rostre rouge, non caréné mais seulement pointillé et pourvu latéralement d'un court sillon de chaque côte à la base. Prothorax presque du double aussi large que long, les côtés légèrement divergents en avant et rectilignes sur leur tiers

postérieur, puis graduellement convergents et à peu près rectilignes, les tubercules latéraux très peu visibles de dessus formant un simple angle obtus, bien distincts, en arête squamulée, vers de profil; modérément convexe, densément ponctué, la pubescence cendrée fine et régulièrement répartie. Ecusson petit, cendré. Elytres une fois et un tiers aussi longs que larges, les épaules presque effacées, le calus huméral à peine indiqué; régulièrement convexes, les stries fines, les interstries plans. Pattes et dessous à fine pubescence cendrée. Fémurs antérieurs fortement renflés; tibiaux normaux. Prosternum concave. Longueur, 1.5 à 1.7 millimètres.

Luzon, Mount Maquiling. Singapore (*Baker*).

Telephae grisea sp. nov.

Oblong, brun, les pattes et les antennes ferrugineuses, revêtu en dessus et en dessous d'une pubescence cendrée, couchée, assez serrée, uniformément répartie, un peu plus serrée cependant sur la suture.

Rostre ferrugineux, squamulé à la base, latéralement ponctué-striolé presque jusqu'au sommet, en dessus caréné à la base. Tête ferrugineuse, ponctué, finement pubescente en avant. Prothorax un peu moins long que large, les côtés rectilignes en arrière des tubercules latéraux, les angles postérieurs droits, modérément rétréci en avant, les tubercules latéraux saillants, arrondis au sommet, cornés, leur base prolongée en arrière jusqu'à la base du prothorax; convexe, obliquement et assez fortement relevé des bords au milieu, la ponctuation serrée et finement rugueuse, la pubescence assez fournie et transversalement dirigée vers la ligne médiane. Ecusson oblong, petit, pubescent. Elytres en demi ovale, de un tiers plus longs que larges ensemble, les épaules obliques, le calus huméral peu marqué; régulièrement et assez fortement convexes, les stries profondes, glabres, leurs points bien visibles et entamant les interstries, les interstries plans, ponctués, munis chacun de deux ou trois rangs de poils. Pattes pubescentes, les tibiaux étroits, les tarses grêles, le 1^{er} article plus long que les deux suivants réunis. Prosternum dépourvu de tubercule derrière les hanches antérieures. Longueur, 2.1 à 2.3 millimètres.

Borneo, Sandakan (*Baker*).

Telephae ferruginipes sp. nov.

Oblong, brun noir, les élytres, les antennes, les pattes (fémurs antérieurs exceptés) ferrugineux, les élytres ornés de deux

fascies transversales de poils squamuleux jaunâtres, l'une basale, l'autre postmédiane, pourvus en outre d'une linéole suturale antéapicale et d'une très courte linéole sur le 4^e interstrie un peu avant le sommet, le dessous revêtu de squamules linéaires grisâtres assez serrées.

Rostre latéralement comprimé, ponctué striolé à la base, caréné en dessus, lisse et brun en avant. Tête densément ponctué. Prothorax presque du double aussi large que long, régulièrement et assez fortement arqué sur les côtés; les angles postérieurs obtusément arrondis, les tubercules latéraux saillants, cornés, arrondis au sommet; régulièrement et assez fortement convexe, la ponctuation serrée, confluyente en rides, la pubescence peu serrée formant une large bande sur les côtés et une tache devant l'écusson. Ecusson petit, pubescent, entouré d'un sillon. Elytres en demi ovale, les épaules très obliques et arrondies, le calus huméral faible; convexes, déprimés autour de l'écusson, les stries étroites, profondes, glabres, leurs points indistincts, les interstries plans, ruguleux, munis de deux ou trois rangs de poils squamuleux en partie brun foncé et en partie jaunâtres. Pattes à pubescence fine et éparses. Prosternum dépourvu de tubercule derrière les hanches antérieures. Longueur, 2.2 millimètres.

Borneo, Sandakan (*Baker*).

Telephae lineolata sp. nov.

Oblong, brun noir, les antennes et les tarses testacés, revêtu en dessus d'une pubescence brune et jaune, cette dernière formant sur les élytres deux fascies transversales formées de linéoles très inégales la 1^{re} basale, la 2^e médiane, les linéoles de la 1^{re} plus courtes sur les interstries pairs que sur les impairs, celle de la suture couvrant son tiers antérieur, la fascie médiane très ondulée, sa linéole suturale la plus longue, les 2^e, 4^e, 9^e interstries ont en outre une linéole près du sommet.

Rostre caréné et ponctué à la base, roux au sommet. Prothorax un peu moins long que large, les côtés arrondis, brusquement et assez largement rétréci resserré en avant; les angles postérieurs obtus, les tubercules latéraux squamulés, allongés en forme de crête, très peu saillants vers de haut, saillants latéralement vers de profil, modérément convexe, la ponctuation serrée, la ligne médiane élevée, la pubescence jaune éparses sur le disque, plus serrée sur la ligne médiane et les angles. Ecusson arrondi, pubescent, jaune, placé au centre d'une petite dépression et entouré d'un sillon. Elytres en demi

ovale, visiblement plus longs que larges, les épaules peu obliques, le calus huméral assez élevé; convexes, les stries étroites et profondes, les interstries plans, rugueux. Pattes et dessous à pubescence jaunâtre plus courte et plus fine que celle du dessus. Longueur, 2.7 à 3 millimètres.

Borneo, Sandakan (*Baker*).

Telephae striata sp. nov.

Oblong, brun noir, les antennes et les tarse testacés, revêtu en dessus d'une pubescence squamuleuse cendrée jaunâtre irrégulière et assez serrée et d'une pubescence d'un brun foncé formant sur les élytres deux fascies très irrégulières, étroites, la 1^{re} vers le tiers antérieur, la 2^e vers le tiers postérieur, le 9^e interstrie brun vers le sommet.

Rostre brun, ponctué et caréné à la base. Prothorax à peine plus large que long, les côtés subparallèles jusqu'au tiers antérieur, puis assez fortement rétrécis sinués en dedans, les tubercules latéraux modérément saillants, squamulés, leur bord postérieur oblique; modérément convexe, la ponctuation assez forte et serrée en arrière, fine en avant, la pubescence assez serrée, plus cendrée dans les angles postérieurs, laissant deux bandes dénudées étroites en arrière, réunies et formant une large bande médiane à partir du milieu. Ecusson, ovale, cendré, entouré d'un sillon. Elytres en demi ovale, peu plus larges que le prothorax, au moins une fois et demie aussi longs que larges ensemble, les épaules très obliques, le calus huméral très élevé et cendré; convexes, les stries profondes, peu distinctement ponctuées, les interstries plans, rugueux, le bord apical étroitement ferrugineux. Pattes revêtues d'une pubescence cendrée fine mais serrée, les tibias ferrugineux. Dessous à pubescence squamuleuse cendrée assez dense. Longueur, 2.5 millimètres.

Borneo, Sandakan (*Baker*).

Telephae pusilla sp. nov.

Ovale, brun noir, les pattes et les antennes d'un rouge ferrugineux, la pubescence cendrée dorsale fine, formant cinq taches sur le prothorax, trois basales et deux antérieures plus petites, deux fascies sur les élytres, l'une basale, fortement prolongée sur les deux premiers et la suture et par suite étroitement séparée de la 2^e, cette dernière médiane, la suture avec une linéole vers le sommet.

Rostre foncé, caréné, ponctué et pluristriolé à la base, ferrugineux, pointillé et brillant au sommet. Prothorax transversal, modérément arqué sur les côtés, fortement rétréci et un peu étranglé latéralement en avant, sans tubercule ni tache squamuleuse spéciale, peu convexe, un peu relevé le long de la ligne médiane, la ponctuation serrée et granuleuse, la tache basale et médiane plus petite que les latérales. Ecusson arrondi, cendré, entouré d'un sillon. Elytres en demi ovale, un peu plus longs que larges, les épaules brièvement arrondies, le calus huméral indistinct; modérément convexes, profondément déprimés le long de la suture en avant, les stries fines, les interstries plans, finement ponctués granulés. Dessous et pattes à pubescence cendrée fine et courte. Fémurs antérieurs peu renflés, presque linéaires; tibias antérieurs modérément arqués, faiblement élargis dans leur moitié apicale. Prosternum légèrement concave. Les fémurs antérieurs sont seulement aussi larges que les postérieurs. Longueur, 1.6 millimètres.

Mindanao, Davao (*Baker*).

Telephae nigricornis sp. nov.

Noir, revêtu de dessus d'une pubescence excessivement courte mate d'une brun foncé et orné sur les élytres de courtes linéoles blanches: deux sur la suture, l'antérieure postscutellaire, la deuxième médiane, une sur la base des 2^e et 3^e interstries, une vers le milieu du 4^e.

Rostre noir, gros, court, à la base finement caréné au milieu, finement ponctué striolé latéralement, lisse et brillant en avant. Antennes noirâtres, foncées. Prothorax transversal, les côtés subparallèles de la base au milieu, fortement rétrécis sinués en avant, sans tubercule ni tache squamuleuse particulière, les angles postérieurs presque droits; modérément convexe, largement mais peu profondément impressionné transversalement en avant, la ponctuation serrée et granuleuse, la pubescence mate et assez dense. Ecusson enfoncé, arrondi, à pubescence mate. Elytres en demi ovale, un peu plus longs que larges, les épaules arrondies, les calus huméral assez élevé, arrondi, rugueux; moyennement convexes, fortement impressionnés autour de l'ecusson, les stries ponctués, les interstries plans et fortement rugueux, la 9^e strie entière et creusée sous l'épaule, les linéoles claires de la suture séparées par des taches d'un brun noir, foncées. Pattes et dessous revêtus d'une fine pubescence cen-

drée. Fémurs antérieurs assez fortement renflés, visiblement plus épais que les postérieurs, les tibias antérieurs fortement arqués. Prosternum largement et profondément canaliculé devant les hanches antérieures. Longueur, 2 millimètres.

Singapore (*Baker*).

Telephae neglecta sp. nov.

Noir brun, les antennes, les tarses testacés, les tibias ferrugineux, la pubescence dorsale fine, très éparse, jaune, formant trois linéoles sur la suture, la médiane la plus longue, l'apicale très courte, une courte linéole sur la base des interstries 2°, 3°, 4°; bord apical des élytres non explané, étroitement ferrugineux.

Rostre épais, densément ponctué striole à la base, même en dessus, à ponctuation plus fine et moins serrée en avant. Prothorax du double aussi large que long, les côtés subparallèles de la base en milieu, fortement rétrécis sinués en avant, sans trace de tubercule ni de tache squamuleuse, les angles postérieurs largement arrondis; peu convexe, un peu relevé le long de la ligne médiane, largement mais peu profondément impressionné transversalement derrière le bord antérieur, couvert d'une ponctuation fine, très serrée, un peu granuleuse, la pubescence brune peu visible, la pubescence jaune formant seulement deux taches légères de chaque côté, une basale, une médiane petite et arrondie. Ecusson arrondi, pubescent, entouré d'un sillon. Elytres en triangle curviligne, peu plus longs que larges ensemble, leur plus grande largeur un peu en arrière des épaules, ces dernières arrondies; peu convexes, largement et profondément déprimés le long de la suture, les stries fines, les 7° et 8° n'atteignant pas la base, la 9° fortement creusée sous l'épaule, les interstries plans, couverts de très petits granules très serrés. Dessous revêtu de très courtes soies fines, cendrées; pubescence des pattes extrêmement fine et cendrée. Fémurs antérieurs très peu renflés; tibias antérieurs modérément arqués, leurs bords parallèles. Prosternum légèrement concave en avant des hanches. Longueur, 2.5 millimètres.

Borneo, Sandakan (*Baker*).

L'un des exemplaires a une courte linéole jaune sur le milieu des 2°, 3°, et 4° interstries et les deux taches latérales du prothorax sont reliées entre elles et forment une étroite bande latérale.

Telephae maculithorax sp. nov.

Noir brun, les antennes, les tibias et les tarses ferrugineux, revêtu en dessus d'une pubescence squamuleuse d'un rouge d'ocre

formant dix taches sur le prothorax, trois larges fascies sur les élytres, très irrégulières, alternant avec deux fascies dénudées, noires, plus étroites, incomplètes, les fascies claires reliées sur les côtés, la linéole médiane de la suture cendrée-rougeâtre et placée en arrière des interstries adjacents.

Rostre brun rouge, à la base finement caréné au milieu, ponctué-striolé latéralement, squamulé, en avant pointillé et brillant. Prothorax un peu plus large que long, les côtes modérément arqués, rétrécis sinués dans leur tiers antérieur, sans tubercule ni tache squamuleuse particulière, les angles postérieurs obtusément arrondis; assez fortement convexe, la ligne médiane élevée, la ponctuation serrée, les taches squamuleuses (3, 4, 1, 2) grandes, les taches dénudées irrégulières et moins grandes. Ecusson densément squamulé, entouré d'un sillon. Elytres un peu plus longs que larges, le calus huméral grand, élevé et densément pubescent; convexes, légèrement déprimés le long de la suture en avant, les stries ponctuées, les interstries plans, finement ponctués. Pattes et dessous à pubescence plus fine mais de même coloration que celle du dessus. Fémurs antérieurs modérément renflés; tibias antérieurs arqués, leurs bords parallèles. Prosternum profondément canaliculé en avant, pourvu derrière les hanches antérieures d'une lamelle en forme de croissant, ses extrémités en tubercules aigues et densément pubescents. Longueur, 2,5 millimètres.

Borneo, Sandakan (*Baker*).

Mecysmoderes luzonicus sp. nov.

Rouge ferrugineux, les élytres plus clairs, glabre en dessus, la suture seule pourvu d'une ligne de squamules claires de chaque côté de la carène scutellaire, pourvu en dessous de quelques squamules d'un blanc jaunâtre sur le milieu du metasternum, les points des côtés pourvus d'une soie excessivement fine et courte.

Rostre mince, beaucoup plus long que la tête et le prothorax, à la base superficiellement ponctué striolé et presque mat, en avant lisse pointillé, brillant. Antennes fines et courtes, le 1^{er} article du funicule obconique, le 2^e plus court, oblong, les suivants très courts et serrés, la massue ovale oblongue. Prothorax subtrapézoïdal, beaucoup plus large que long, brièvement contracté en avant, convexe, couvert sur les côtés de points profonds, au milieu de fins sillons superficiels séparés par d'étroites et obtuses carènes sinueuses, la carène médiane assez vive et entière prolongée en arrière sur la suture presque jusqu'au

milieu. Elytres courts, le calus huméral peu saillant, les sillons larges, leurs points entamant les interstries, les interstries pas plus larges que les stries, convexes, subcarénés particulièrement en arrière. Pattes courtes, les fémurs munis d'une petite dent, les postérieurs fortement épaisses et beaucoup plus épais que les autres; tarses très courts, le 1^{er} article un peu plus long que large. Dessous à ponctuation forte et espacée sur la poitrine et le 1^{er} segment ventral, très fine et uniseriée sur les 3^e et 4^e segments. Canal rostral peu profond terminé sur le mésosternum. Longueur, 1.5 millimètres.

Luzon, Mount Maquiling (*Baker*).

DIPTERA OF MEDICAL AND VETERINARY IMPORTANCE, II

THE MORE IMPORTANT BLOWFLIES, CALLIPHORINÆ

By W. S. PATTON
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In a previous paper ¹ I gave an account of my studies of the types of some Muscinæ of medical and veterinary importance. In the present paper I shall deal with the more important blowflies, the Calliphorinæ.

Genus CALLIPHORA Robineau-Desvoidy

This genus is usually divided into a number of subgenera on the characters of the epistome, the hairiness or otherwise of the eyes and squamæ, and the number and arrangement of the sternopleural bristles. Johnston and Hardy have recently given the following key to some of the genera:

- | | |
|--|------------------|
| 1. Eyes bare..... | 2. |
| Eyes hairy..... | 3. |
| 2. Epistome conspicuously protruding..... | Anastellorrhina. |
| Epistome scarcely if at all protruding..... | Calliphora. |
| 3. Epistome scarcely if at all protruding..... | Neocalliphora. |

As there are many intermediate forms with respect to the characters used in this key, and as the species are at present very imperfectly understood, I consider it is best in the meantime to include all the species under the genus *Calliphora*. Hairiness or otherwise of the eyes is a weak character on which to base genera in the Diptera. -

The genus *Calliphora* in this wide sense may be defined as follows:

The eyes of the male are as a rule closely approximated, and either bare or hairy, those of the female widely separated, and the front may be equal to the width of the eye. There are nearly always two strongly developed decumbent parafrontal bristles; the parafacials often have two silky yellow spots. The

¹ Philip. Journ. Sci. 27 (1925) 177-200.

lower part of the face and also the cheeks are densely hairy, the hairs long and either dark or bright red, forming a long beard. The third antennal segment is about four and a half times the length of the second, and the apical fifth or third of the arista may be bare. The epistome in some species is broad and prominent (*Anastellorrhina*), or in others normal (*Neocalliphora*). The palpi are relatively small and in most of the species yellow and narrowly club-shaped. The thoracic chaetotaxy is as follows: Humeral 4, posthumeral 2, presutural 2, notopleural 2, supra-alar 2, post-alar 2, intra-alar 2 or 3, dorsocentral 6 or 7 (3, sometimes 4, in front of the suture and 3 behind it), acrostical 5 (2 in front and 3 behind the suture). Sternopleural bristles variable, usually arranged 2 : 1; in a few 1 : 1. Pleurae densely covered with long hairs. Stigmata and bases of wings in some species bright yellow. The venation similar to that of the species of *Musca*; bend of vein M_{1+2} turns up with a sharp angle and has a shallow bend as it joins the margin of the wing a little behind vein R_{4+5} ; mediocubital cross vein joins vein M_{1+2} close to the bend; vein R_{4+5} has small bristles on both the surfaces at the base. Squamae with long hairs sparsely scattered on the dorsal surface and not as a rule reaching the margin. The following notes on some of the species may be of use:

Calliphora erythrocephala Meigen.

Calliphora vomitoria Linnaeus.

These are the two common European blowflies; in the former the cheeks are red with black hairs, in the latter black with red hairs. *Calliphora erythrocephala* is recorded from Australia, and both species are not uncommon in the hill stations in North India.

Calliphora aucta Walker.

This is also an Indian species and is found in the hill stations in North India, and in Burma; the cheeks of this species are black with black hairs and the mesothoracic stigmata are dark brown; the color of the abdomen is similar to that of *vomitoria*.

Calliphora fulviceps v. d. Wulp.

A large species, found in the mountainous regions of Java, Sumatra, and Borneo; it can be easily recognized by its bright red cheeks with long red hairs and bright orange stigmata.

Calliphora quadrimaculata Swederus.*Calliphora sacra* Fabricius.*Calliphora dasyophthalma* Macquart.*Calliphora testaceifacies* Macquart.*Calliphora violacea* Walker.

A common Tasmanian blowfly; it may possibly be found in parts of Australia also. It can be recognized by its hairy eyes, yellow stigmata, and bases of wings. It is not an important blowfly and, as far as I am aware, does not deposit its eggs in soiled wool. The synonyms noted above are based on the examination of types.

Calliphora dispar Macquart.*Calliphora pubescens* Macquart.*Calliphora ruficornis* Walker.

Not a common blowfly, but Doctor Ferguson recently sent me a number of specimens from Sydney. I have compared them with Macquart's type, a male, and find they are identical. The type of *C. dispar* is a female of *C. pubescens* and, as it is the older name, it must be used instead of *pubescens*.

Calliphora hyalipennis Macquart.*Calliphora ochracea* Schiner.

This is the well-known reddish brown blowfly of Australia. It has been placed in the genus *Neocalliphora* by Brauer and Bergenstamm and in the genus *Adichosia* by Surcouf. I note that Johnston and Hardy include *hyalipennis* as a distinct species in the genus *Neocalliphora*; the types of *hyalipennis* are typical specimens of *ochracea* and, as the former is the older name, it must replace the latter.

Calliphora stygia Fabricius.*Calliphora australis* Boisduval nec Macquart.*Calliphora villosa* Robineau-Desvoidy.*Calliphora laemica* Walker.*Calliphora rufipes* Macquart.

This is the common sheep-maggot fly of Australia, where it is known as the golden-haired blowfly. It has been placed in the genus *Neopollenia* by Brauer, in *Tricocalliphora* and *Paracalliphora* by Townsend, and in *Proekon* by Surcouf. It is the species named by Macquart *Lucilia rufipes*, as was correctly determined by Brauer; *Anastellorrhina bicolor* Bigot is not this species, as noted by Johnston and Hardy, but is *C. augur*.

Calliphora tibialis Macquart.

This is smaller but somewhat similar to *C. stygia*; the thorax is not so slate blue but is dark gray; the abdomen is, however, very similar; the first abdominal tergite is darker than in *stygia*, the legs are dark, whereas in *stygia* the femora and tibiae are yellow; the male has no large facetted area as has that of *stygia*. I have compared with Macquart's type a number of specimens sent me by Mr. Hill and Doctor Ferguson and find they are identical. Johnston and Hardy place this species in the genus *Anastellorrhina* Bigot, and Townsend places it in the genus *Paracalliphora*.

Calliphora hilli sp. nov.

Male.—Front about one-eighth to one-ninth the width of eye; parafacials and cheeks grayish yellow with yellow hairs. Eyes without a large facetted area as in *C. stygia*. First and second antennal segments dark orange, third segment mouse gray; palps yellow, small, and slightly club-shaped. Thorax and abdomen very similar to those of *C. stygia*; stigmata light orange; femora and tibiae of all legs light orange, all tarsi dark. I have not seen the female. As I was unable to find any type or named specimen of this species in any of the collections I examined, I consider it is new and have much pleasure in naming it for Mr. Hill who has added so much to our knowledge of the Diptera of medical and veterinary importance of Australia. Three of the specimens I have seen were collected by Mr. Hill from Bamawm, Victoria, and the fourth from Seaford.

Calliphora augur Linnæus.

Calliphora lateralis Macquart.

Calliphora oceaniae Robineau-Desvoidy.

Calliphora dorsalis Walker.

Calliphora bicolor Bigot.

Calliphora dichromata Bigot.

Calliphora xanthuria Bigot.

Calliphora selasoma Erichson.

This is another widely distributed Australian sheep-maggot fly; it, like *C. stygia*, has been placed in several genera. Johnston and Hardy include among its synonyms *rufiventris* Macquart and *rufiventris* Bigot. I was unable to find any types or named specimens of either of these species in Paris or in Bigot's collection of Calliphorinæ; the names would best be deleted from the literature. I also note that these authors include *lateralis* Macquart as a synonym of *stygia* and of *augur*. I

may point out that it is a synonym of *augur*. Bigot placed *augur* in the genus *Phumosi*, naming it *xanthuria*, the type of which is a typical specimen of *C. augur*. I consider that the type of *Phumosi dichromata* Bigot, a male, is a small specimen of *augur*; it differs from the typical *augur* in some slight details.

I may point out that the *Calliphora rufipes* of Macquart is probably the South American species *segmentaria*. I am unable to be certain of the identity of *C. tessellata* Macquart, as the type is in a very bad state of preservation and is now a mere shell; it is a bluish green species and I am nearly certain it is another specimen of *C. pubescens*. I could find no type or named specimen of *Pollenia viridiventris*; but *tasmanensis* is a good species of this genus and Doctor Ferguson sent me a specimen recently. I have already noted that *Calliphora aureopunctata* and *C. aureonotata* are species of *Onesia*. I was unable to find any type or named specimen of *C. clausa* Macquart; the name is best deleted from the literature as unrecognizable.

Calliphora croceipalpis Jaennicke.

Calliphora vicarians Schiner.

Calliphora parasacra Speiser.

This is the common Ethiopian species and is found in the mountainous regions of East Africa.

The following key to the more important Australian species of the genus *Calliphora* sens. lat. may be of some use in the identification of species:

*Key to the more important Australian species of the genus
Calliphora sens. lat.*

1. Eyes hairy 2.
Eyes bare 3.
2. Large bluish black species with bright yellow stigmata and bases of wings. (Tasmania.) *C. quadrimaculata* Swederus.
Large golden yellow species with long yellow hairs; wings yellowish at their bases *C. hyalipennis* Macquart.
3. Large bluish or bluish green species 4.
Either large or medium-sized golden yellow species with slate blue or dark gray thorax. Abdomen either orange with blue stripes and bands, or golden yellow with bronzy sheen 5.
4. Cheeks red with black hairs. Front of male very narrow. Abdomen with shimmering white patches *C. erythrocephala* Meigen.
Cheeks dark gray with black hairs. Eyes of male well separated. Abdomen with white pollen at sides and markedly green toward the apex. *C. dispar* Macquart.

5. Either large or medium-sized species. All femora and tibiae light orange, all tarsi dark gray or blackish..... 6.
 Medium-sized species. Thorax dark bluish gray with two narrow admedian presutural stripes. Abdomen golden yellow with some bronzy sheen. All legs dark brown to black..... *C. tibialis* Macquart.
 6. Large golden-haired species. Eyes of male meeting in the middle line with a well-marked area of large facets; front of female equal to width of eye. Face and cheeks yellowish with yellow hairs. Thorax slate blue with faintly marked admedian presutural stripes; pleurae with long yellow hairs. Abdomen golden yellow with bronzy sheen. Sternopleural bristles arranged, 1:1..... *C. stygia* Fabricius.
 Very similar but smaller. Male eyes distinctly separated and without any large faceted area..... *C. hilli* sp. nov.
 Large orange species. Eyes of male a little separated without a large faceted area; front of female not quite equal to width of eye. Face and cheeks yellowish with short dark hairs and longer silky ones. Abdomen orange with a broad median metallic blue stripe on tergites 1 to 3, widest on the latter; fourth tergite yellowish.

C. augur Linnæus.

Genus *LUCILIA* Robineau-Desvoidy

In this genus are included those *Calliphorinæ* in which the eyes of the male are closely approximated (rather widely separated in a few), and those of the female are widely separated. The third antennal segment is about four times as long as the second, and the arista has hairs on both sides almost to the tip, so that the bare apical portion is short. The palps are usually yellowish, seldom dark. The epistome is somewhat prominent. There are always two well-developed decumbent parafrontal bristles as in *Calliphora*. The thoracic chaetotaxy is similar to that of *Calliphora*; the number of the post-sutural acrostical bristles varies in the species and they are a useful character for separating the species. The three sternopleural bristles are arranged 2:1. The venation is similar to that of *Calliphora*, vein M_{1+2} bends up with rather a sharp angle, and joins the costa well behind vein R_{4+5} . The radius is always bare, as in *Calliphora*, vein R_{4+5} has a row of bristles on its upper and lower surfaces, the former extending toward the radiomedial crossvein, the latter almost up to it. The squamæ are always bare.

Most of the species of this genus are metallic green or blue, though one Australian species to be described presently is yellowish. The species of this genus must not be confused with those of *Cryptolucilia* and *Pyrellia*, which belong to the *Muscinae* and therefore have no hypopleural bristles.

The species that are of importance from the medical and veterinary standpoint are *Lucilia sericata* Meigen, *L. cuprina* Wiedemann, *L. nosocomiorum* Doleschall, and *L. fergusonii* sp. nov. The following notes and key to these species will be found useful:

Lucilia fergusonii sp. nov.

Male.—Eyes almost meeting in the middle line. Face, cheeks, antennæ, and palps golden yellow, the cheeks with golden hairs; arista dark. Mesonotum metallic blue with white pollen; two or three presutural dorsocentral and acrostical bristles and two postsutural acrostical bristles; pleuræ orange yellow; sternopleural bristles 2:1, in one male 3:1. Abdomen orange; first tergite orange with a very narrow dark posterior band; second tergite with a metallic blue triangular patch not reaching the anterior margin, and forming a narrow posterior band; third tergite with a larger blue patch almost covering the whole of the tergite. Femora and tibiæ orange; tarsi dark brown. Vein R_{4+5} with bristles on both sides, as noted above. Squamæ bare.

Female.—Front almost half the width of the eye; parafrontals yellow. In all other respects similar to the male.

Doctor Ferguson recently sent me one female and two males of this interesting species from Sydney, and I have much pleasure in naming it for him; it is the only species of this genus known to me which is of an orange color. It may be confused with *C. augur*, which it resembles superficially. It can, however, be distinguished at once by noting that in *augur* the squamæ are hairy, while they are bare in *fergusonii*; there are many other distinguishing characters, but this one is the most certain. The mesonotum of *augur* is not metallic blue but slate blue. It may be confused also with *Chrysomya incisuralis*; the characters distinguishing the two will be noted under that species. It is quite possible that *L. fergusonii* may prove to be a sheep-maggot fly.

Lucilia sericata Meigen.

This species can be distinguished from its near ally *L. caesar* Linnæus by noting that in the former there are always three postsutural acrostical bristles, whereas in *L. caesar* there are only two. The front of the male *sericata* is about one-third the

width of the eye; the eyes of the male *caesar* are closely approximated. In both species the palps are yellowish.

Lucilia cuprina Wiedemann.

Lucilia argyricephala Macquart.

Lucilia serenissima Walker.

This species can be distinguished by noting that there are three post-sutural acrostical bristles; that the front of the male is about one-fourth the width of the eye; that the thorax and abdomen have well-marked white pollinosity; and that the latter is often of a bronzy sheen and much more light green than that of *sericata*. *Lucilia cuprina* is an Oriental and Ethiopian species.

Lucilia nosocomiorum Doleschall.

Lucilia marginifera Walker.

Musca rutescens Walker.

Lucilia inscribens Walker.

Lucilia nesiotes Schiner.

Lucilia nebulosa Bigot.

Lucilia pachymosa Bigot.

Lucilia japonica Bigot.

? *Lucilia jeddensis* Bigot.

Lucilia cyaneo-marginata Bigot.

Lucilia tasmaniensis Froggatt (nec Macquart).

A large species, common in the Australian Region, and probably a sheep-maggot fly in some of the localities where it is found; it is not unlike the Oriental *L. inducta* Walker. It can be distinguished from *L. sericata* by noting that the eyes of the male almost meet in the middle line and that there are only two post-sutural acrostical bristles; it may be confused with *L. caesar*, but it is a much bluer fly and the eyes of the male are closer together than are those of the male *caesar*; the female front is less than half the width of the eye, whereas in the female *caesar* it is exactly or a little more than half the width of the eye. *Lucilia nosocomiorum* is closely allied to *L. inducta* from the Oriental Region and it is possible that they are the same; more material of the Australian species is required before this can be settled. I trust Australian workers will send me its larvæ and a good series of adults.

The species discussed may be distinguished by the following key:

Key to the important species of the genus Lucilia.

1. Two post-sutural acrostical bristles..... 2.
 Three post-sutural acrostical bristles..... 4.
2. Entirely metallic species 3.
 Orange species with metallic markings. Eyes in the male almost meeting in the middle line; front of female about half the width of the eye. Face, cheeks, antennæ, and palps yellow. Mesonotum metallic blue, pleuræ orange. Abdomen orange; first tergite orange with narrow posterior dark band; second tergite with blue triangular patch not reaching anterior border of segment, and forming a narrow posterior band; third tergite with large blue patch almost covering the whole tergite. Femora and tibiæ orange, tarsi dark. (Australian Region.)..... *L. fergusonii* sp. nov.
3. Front of male very narrow, eyes a little separated; front of female about half the width of the eye. A bright metallic green species. (Australia, South Africa, Europe.)..... *L. caesar* Linnæus.
 Front of male very narrow, the eyes almost meeting; front of female much less than half the width of the eye. A large metallic species. (Australian Region.)..... *L. nosocomiorum* Doleschall.
4. Front of male about one-third the width of the eye; front of female about equal to the width of the eye. A green to dark green species with white pollen on thorax..... *L. sericata* Meigen.
 Front of male about one-fourth the width of the eye; front of female about equal to or a little wider than the width of the eye. A smaller fly of a brighter metallic green with well-marked white pollen and bronzy sheen, especially on abdomen. Oriental and Ethiopian.
L. cuprina Wiedemann.

Genus CHRYSOMYIA Robineau-Desvoidy

The species belonging to this genus are mostly medium-sized Calliphorinæ, but some of the Australian forms are small. Here again several attempts have been made to split the genus up into smaller groups, using such characters as the bristles, epistome, markings of the thorax, and the hairiness or otherwise of the squamæ. As the species are so imperfectly known at present, I consider it best to keep them in the single genus *Chrysomyia*, which may be defined as follows:

Eyes in life often of a characteristic brick color and in the males closely approximated (except in a few, *C. villeneuvei* Patton, *C. laxifrons* Villeneuve); in many of the males the upper and middle facets of the eyes are conspicuously enlarged and form a characteristic band; in the female the front is always wide and in some species conspicuously so; there are usually two small parafrontal bristles, one above the other, but they may be wanting. The front and cheeks are either

brownish yellow or silvery, the latter often buff yellow with silky yellow hairs. The epistome may or may not be prominent. The antennæ are either dark reddish yellow or bright orange; the arista has long hairs almost to the tip on both sides; in some species those on the lower surface are shorter. The palps are in the majority of the species yellow. The thorax is often conspicuously white in front of the suture, and is as a rule marked with narrow dark stripes (in one species, *macellaria*, there are three broad dark stripes); this character is not of any generic value. The thoracic chaetotaxy is as follows: Humeral 3; post-humeral 1; presutural 1; notopleural 1; supra-alar 3; intra-alar 2; post-alar 2; dorsocentral 5 or 6 (2 in front of the suture and 3 or 4 behind it, the latter often variable in size and number); acrostical bristles 2, the presutural ones absent; often a small bristle between the basal dorsocentral and acrostical bristles; sternopleural bristles 2 or 3, arranged 1 : 1 or 2 : 1; mesopleural 5 or 6. The abdomen is often marked with dark blue bands at the bases of tergites 2 and 3. The venation is similar to that of *Calliphora* and *Lucilia*; vein R_{4+5} has a row of strong bristles on its dorsal surface extending toward the radiomedial crossvein, and there are a few small bristles at the base on the ventral side; the root of the radial sector nearly always has long hairs on its posterior border. The squamæ with few exceptions are covered with long hairs on the dorsal surface.

This genus contains the important myiasis-producing Calliphorinæ; *C. bezziana* and *C. macellaria* are the two best-known species. The following notes will be of use in identification of species.

The three most important Old World species of this genus are *Chrysomya megacephala* Fabricius, *C. bezziana* Villeneuve, and a third species closely related to the other two. As already noted, *C. megacephala* is an Oriental and Australasian species, *C. bezziana* is found in the Ethiopian and Oriental Regions, and the third species is Australasian. The last-mentioned species was sent to me by Mr. Illingworth and Mr. Hill from different localities in Australia; though I recognized it was distinct from *megacephala* and *bezziana* I was unable to give it a name, and I could not find a single specimen in any of the collections I examined until I came to work through Bigot's collection where I found it described under the name *micropogon*. I have little

doubt that this species has been confused with *megacephala* in the Australasian Region.

For some time I have made a special effort to find out the eastern limit of the distribution of *C. bezziana*, a point of considerable importance, for this fly is one of man's most serious pests. Until recently I believed it did not extend beyond Java, but fresh evidence has now come to light which shows that it is widely distributed in the Philippine Islands.

In a recent paper on the foot maggot, *Booponus intonsus* Aldrich of the Philippine Islands, Woodworth and Ashcraft¹ draw attention to the larva of this fly, and point out how it can be distinguished from the common screw worm of the Philippines, which they record as *Compsomyia dux*. From their description of the larva of *dux*, which as I have shown is *Chrysomya megacephala* Fabricius, and from the illustrations of its anterior and posterior extremities and the structure of the anterior spiracle, I have no doubt whatever that the larva they refer to as the common screw worm of the Philippine Islands is not that of *C. megacephala* but is the larva of *C. bezziana*. The anterior spiracle of the larva of *megacephala* always has ten or eleven openings and that of the larva of *bezziana* six; further, the plates of the posterior stigmata of the larva of *bezziana* are smaller than are those of the larva of *megacephala*. The anterior spiracles of the common screw worm of the Philippines according to Woodworth and Ashcraft has six openings, and the posterior stigmatic plates as illustrated are typical of the larva of *C. bezziana*. Short of examining a larva of this common Philippine myiasis-producing calliphorine I have no doubt that the common screw-worm fly of these Islands is *C. bezziana*. It would be interesting to know if *C. bezziana* in the Philippine Islands ever attacks man. In Africa, so far as is known at present, it only deposits its eggs in the tissues of animals, but in India it is a common human parasite. I will be very glad if medical or veterinary officers in the Philippine Islands will send me the larvæ of this fly and keep a lookout for it in human tissues.

As there is the possibility that *C. bezziana* may yet find its way into Australia, it is important that entomologists as well as medical and veterinary officers should be able to recognize it as well as its near allies *C. megacephala* and *C. micropogon*.

¹ Philip. Journ. Sci. 22 (1923) 143.

I imagine it would be an unfortunate event to the sheep-farming industry if *C. bezziana* established itself in Australia. The three species can be distinguished by noting the following points:

The male of *megacephala* has a well-marked band of large facets on the front of the eyes; the facets of the eyes of the males of *bezziana* and *micropogon* are all about the same size, so that it is always easy to separate the male of *megacephala* from the males of the other two species. It is not so easy to distinguish the male of *bezziana* from that of *micropogon*, but in the former the parafrontals and parafacials are silvery, whereas those of the latter are grayish yellow. The face and cheeks of the male *bezziana* are saffron color; those of the male of *micropogon* are much darker yellow. The third antennal segment of *bezziana* is lighter yellow than that of *micropogon*. The most reliable character is to be found in the squamæ; in *bezziana* they are waxy white, in *micropogon* they are of a dirty gray color.

The females of the three species are difficult to distinguish, and an expert opinion is necessary in most cases unless the observer has specimens of all three species before him for comparison. The following characters should be mainly relied on to separate them: The front of the female *bezziana* is almost exactly half the width of the eye; the frontal stripe is reddish brown with straight sides and is almost the same width throughout; the parafrontals and parafacials are silvery below, grayish yellow in the middle, and blackish at the vertex, and are nearly the width of the frontal stripe. The front of the female *micropogon* is distinctly more than half the width of the eye; the frontal stripe is distinctly wider than that of *bezziana* and is also reddish brown; and always a little narrower at its ends, the middle portion being distinctly wider; the parafrontals and parafacials are yellowish gray throughout but darker at the vertex, and about as broad as the frontal stripe. The front in the female *megacephala* is much more than half the width of the eye; the frontal stripe is dark brown, often blackish, is about one-third the width of the eye, and has bulging sides, being narrower at the two ends; the parafrontals and parafacials are dark grayish; the vertex is dark metallic green. The squamæ of *bezziana* are waxy white, whereas those of *megacephala* and *micropogon* are dirty gray.

The other important species of this genus in Australia is *C. albiceps* var. *putoria*, commonly known as *C. rufifacies* Macquart.

When referring to this species Macquart calls it *Lucilia rufifacies* Guerin-Meneville, but there is no such species described by Guerin-Meneville. It seems most likely that Macquart confused the name of Guerin-Meneville's species *Lucilia chrysocephala*, and changed it to *rufifacies*. This species, *chrysocephala*, was described by Guerin-Meneville in 1820, but the plates accompanying his paper are labeled 1832. It is not possible to be certain of this species, from either Guerin-Meneville's description or the colored illustration, and unfortunately the type no longer exists. The illustration shows a calliphorine with green thorax, blue abdomen, and red cheeks; from the description it may quite well be a species of *Lucilia*, for Guerin-Meneville says it has strong recurved hairs, meaning bristles. Professor Bezzi, with whom I discussed this point, agrees with me that *chrysocephala* is a species of *Lucilia*, either *L. caesar* or *L. sericata*, two common Australian species. I could not find a specimen of *rufifacies* in Macquart's collection. It is, I think, best under these circumstances to drop both *chrysocephala* and *rufifacies*.

Chrysomyia albiceps var. *putoria* Wiedemann is the most important sheep-maggot fly of Australia. Its larva is the well-known hairy maggot. There is, however, a closely allied species, the larvæ of which Mr. Illingworth and Mr. Hill have sent me. The larva is very like, if not identical with, the larva of *C. villeneuvei* Patton. It can be distinguished from that of *putoria* by the strong spines on the fleshy processes; the processes of the larva of *putoria* are almost smooth. I hope Australian entomologists will succeed in hatching out this fly when they come across its larvæ.

Another species with a very similar hairy maggot is *C. incisuralis* Macquart (*Ochromyia incisuralis* Macquart), which Surcouf curiously enough places in a new genus, *Psilostoma*; it is a typical species of this genus. I have received a number of specimens from Mr. Illingworth and from Doctor Ferguson; those from the latter show that the northern Australian form is much more orange than are those from the south; it is not known if this species is a sheep-maggot fly.

There are three small species of this genus which Townsend has placed in the genus *Microcalliphora*; I consider they belong to the genus *Chrysomyia*. Two of the species are new and are described below, the third is the well-known *Chrysomyia varipes* Macquart.

Chrysomyia varipes Macquart.

Front of female nearly equal to the width of the eye; frontal stripe broad and dark brown; parafrontals rather dark slate blue; face and cheeks yellowish white. Antennæ and palps orange. Thorax and abdomen dark green; the first abdominal tergite dark blue; the second and third green with broad, dark blue, basal bands. Legs mainly dark brown; fore femora yellow at the apex and along the inner margin; tibiæ dark brown, the apex yellow; tarsi brown; midfemora brown with yellow base and apex, tibiæ and first tarsus yellow, remaining tarsi brown; hind femora with basal third yellow, tibiæ and tarsi similar to those of midlegs. The male is unknown to me.

Chrysomyia fulvipes sp. nov.

Female.—Front considerably less than width of eye; lower half of parafrontals, all parafacials, face, and cheeks yellow; lower half of frontal stripe bright orange, upper half of stripe and parafrontals dark metallic green. Antennæ and palps orange. Thorax bronze green, presutural area shimmering white. Abdomen bright green; first tergite dark blue; second tergite with a broad dark blue basal band; third tergite with a narrower band. All femora, tibiæ, and most of first tarsi orange, remaining tarsi dark. I have not seen the male of this small bronzy green species. The females were collected at Cairns, northern Queensland, and were sent to me by Mr. Illingworth.

Chrysomyia annulipes sp. nov.

Female.—Front a little more than half width of eye; parafrontals and frontal stripe blackish except the lower part of the former which is orange; face and cheeks whitish yellow. Antennæ and palps orange. Thorax bright green; mesothoracic stigmata white; pleura below stigmata with white shimmering pollinosity. Abdomen dark green; first tergite dark blue; second with a broad dark blue basal band, the band on the third tergite narrower. Inner surfaces of fore femora orange, outer dark brown, dorsal surface with a fringe of long, brushlike, yellowish white hairs; fore tibiæ and tarsi dark brown; midfemora with base and apex orange, remainder dark brown; middle tibiæ and first tarsus orange, remainder dark brown; hind femora with apical half dark brown, tibiæ dark orange,

and tarsi dark brown. The type was sent to me by Mr. Illingworth from Cairns, northern Queensland.

The larva of *C. varipes* has fleshy processes like that of *C. albiceps* var. *putoria* and is said to be found commonly in soiled wool. The larva of *C. fulvipes* is smooth. I have not seen the larva of *C. annulipes*. I will be glad to receive any further material, especially the early stages, of these three small species.

In concluding these notes, I should like to express my great indebtedness to Mr. Hill, Mr. Illingworth, Doctor Ferguson, and Mr. W. W. Froggatt for the valuable collections they have sent me from Australia; I could never have accomplished as much as I have in clearing up the synonymy of the Australian species had I not had this extensive material for study.

THIRD REPORT UPON DIPTERA PUPIPARA FROM THE PHILIPPINE ISLANDS

By G. F. FERRIS

Of Stanford University, California

FIVE TEXT FIGURES

This paper is the third of a series dealing with the Diptera Pupipara of the Philippine Islands. For the material upon which it is based I am indebted, in part to Mr. E. H. Taylor, and in part to Mr. R. C. McGregor. Representatives of one species were originally collected by Mr. McGregor but were received by me through the kindness of Dr. M. Bezzi. Specimens of all the species are deposited in the collections of the Philippine Bureau of Science.

NYCTERIBIIDÆ

Genus *CYCLOPODIA* Kolenati

Cyclopodia horsfieldi de Meijere. Fig. 1.

Cyclopodia horsfieldi DE MEIJERE, Tijdschr. v. Entom. 42 (1899) 153.

Cyclopodia horsfieldi de Meijere, SPEISER, Archiv für Naturgesch. 67¹ (1901) 51, 64.

Cyclopodia horsfieldi de Meijere, SCOTT, Parasitology 9 (1917) 607.

Previous records.—From unknown hosts in Java and Sumatra; *Pteropus vampyrus*, Malay Peninsula; *Pteropus philippinensis*, La Carlota, Occidental Negros, Philippine Islands.¹

Specimens examined.—Philippine specimens from *Pteropus speciosus*, Malanipa, Zamboanga (Taylor), *Pteropus vampyrus lunensis* and *Pteropus* sp., Palawan (from alcoholic bats in the United States National Museum); from unnamed *Pteropus*, Bangui, Luzon (McGregor, specimens received by me from Dr. M. Bezzi). Also specimens from *Pteropus hypomelanus enganus*, Engano, Sumatra, and *Pteropus alecto*, Gorontola, Gulf of Celebes (all from alcoholic bats in the United States National Museum).

Notes.—This is one of the large species of *Cyclopodia*; female, 5.5 millimeters; male, 5. According to Speiser² it can be dis-

¹ Scott, H., Parasitology 9 (1917) 607.

² Archiv für Naturgesch. 67¹ (1901) 51.

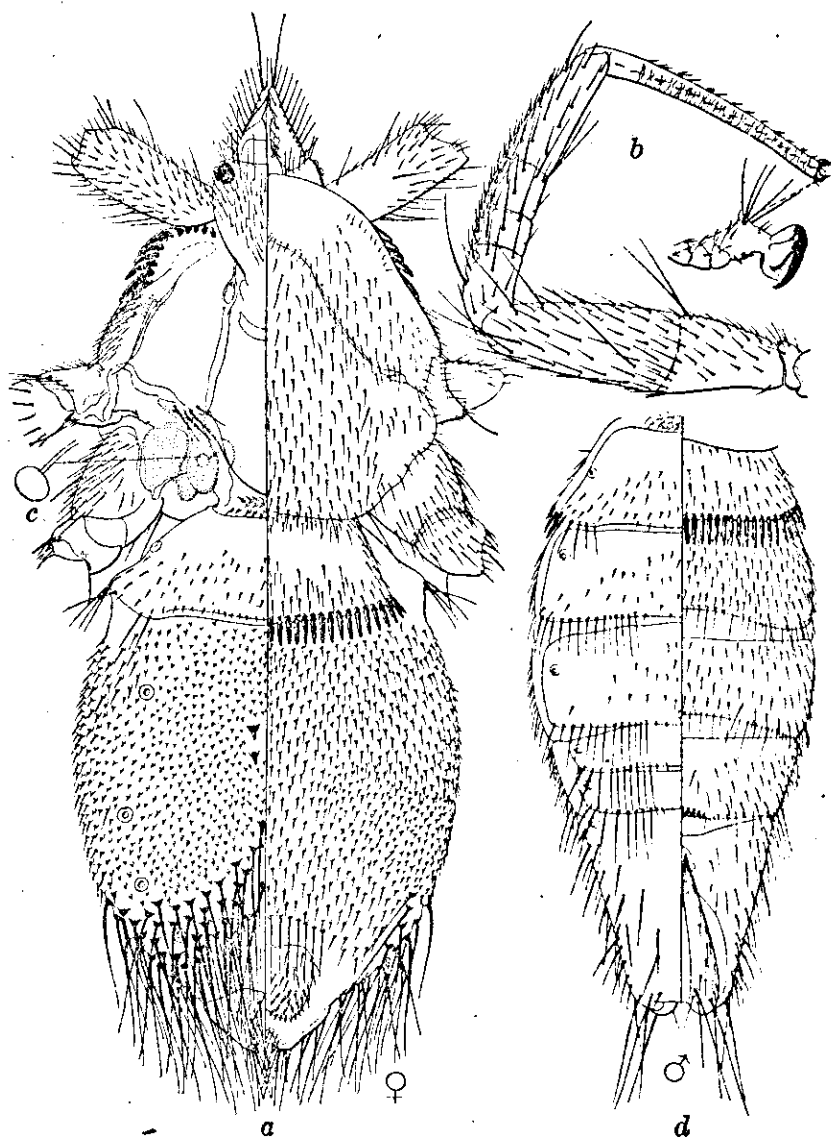


FIG. 1. *Cyclopodia horsfieldi* de Meijere; a, female, legs removed; b, anterior leg; c, halter; d, abdomen of male. All figures to the same scale.

tinguished in the female by the arrangement of the large setae on the abdomen. In this species the long preapical setae are very numerous and extend cephalad toward the short dorsal tubercles, thus forming a triangular area, whereas in the closely related *C. sykesi* they form a single row across the body and in

C. albertisi they are confined to a cluster at each side of the body. There is some variation in the specimens at hand; in some specimens the area of setæ reaches to the dorsal tubercles, in others it does not. In a female from Bangui there are probably not more than half as many of these large setæ as in the other specimens, although there seem to be no other differences, as the setæ are arranged in the same manner. I do not believe that more than one species is present in this material.

The male very closely resembles the males of other closely related species. The presence of small setæ over the dorsal surface of the head may possibly separate it from some other forms.

Scott³ refers to a supposed difference in the halteres of some of the species of *Cyclopodia*. According to him—

* * * in a number of the large species [that is, *C. sykesi*, *C. oxycephala*] they are large, flattened and scale-like, and minutely pollinose, but in *C. ferrarii* and *C. greefi* they are very small, with slender pedicel and knobbed apex.

Cyclopodia horsfieldi is undoubtedly very close to *C. sykesi*, but the halteres are small and knobbed (fig. 1, c). However, they are concealed deeply in a pit between folds of the derm, these folds being thickly beset with minute points. It is probably these folds that Scott misinterpreted as the halteres, for the latter are very difficult to find. In *C. ferrarii* the halteres are exposed.

HIPPOBOSCIDÆ

Genus *LYNCHIA* Weyenbergh

The following assemblage of characters is usually considered as defining this genus: Wings present, functional, noncaducous, with several veins behind the costa and with but one "cross vein," r-m, present, consequently without a basal cell; ocelli absent; claws 3-toothed, scutellum with square posterior-lateral angles. In addition to this, I would call attention to the presence of a fringe of fingerlike processes at the posterior-lateral angles of the scutellum (fig. 3, d), a structure that has been utilized by Lutz, Neiva, and Costa Lima for the separation of this genus from their *Microlynchia*, and the area of transverse striations on the dorsum of the abdomen.

³Parasitology 9 (1917) 607.

Lynchia maura (Bigot). Figs. 2 and 3.

Lynchia maura (Bigot), MASSONAT, Annales de L'Université de Lyon N. S. (1), 28 (1909) 296-303, pl. 1, figs. 6-10.

Previous records.—Apparently this species has been taken only from pigeons. According to Massonat,* experiments in

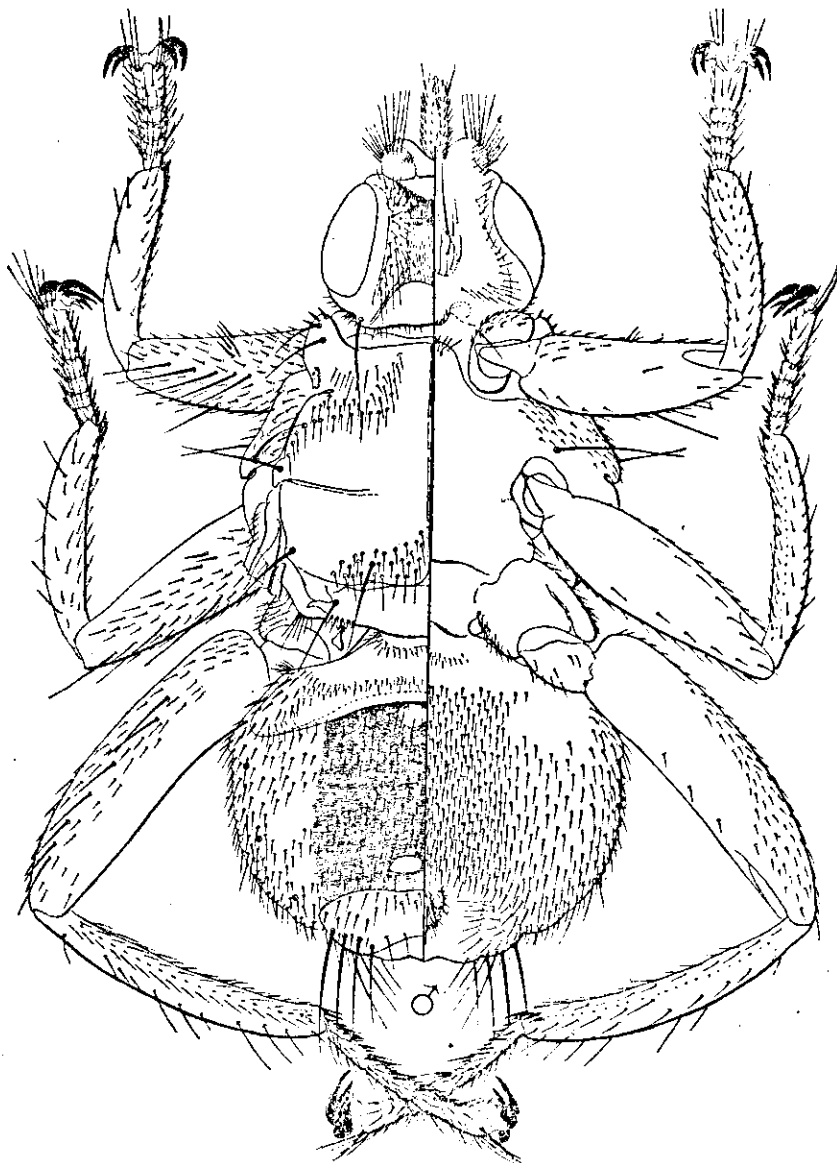


FIG. 2. *Lynchia maura* (Bigot); male, wings removed; from a Philippine specimen.

* Annales de L'Université de Lyon N. S. (1), 28 (1909) 296-303.

which an attempt was made to induce a transfer to other birds failed and the species seems to be confined to the one host. So far as I am aware, it has been recorded only from Europe and northern Africa.

Specimens examined.—A single female, without indication of host, received through the kindness of Doctor Bezzi and presumably coming from Italy; and a single male taken in flight in Manila, March 20, 1924, received from Mr. McGregor.

Notes.—Although the two specimens at hand are of different sex they agree so very closely that I am convinced they repre-

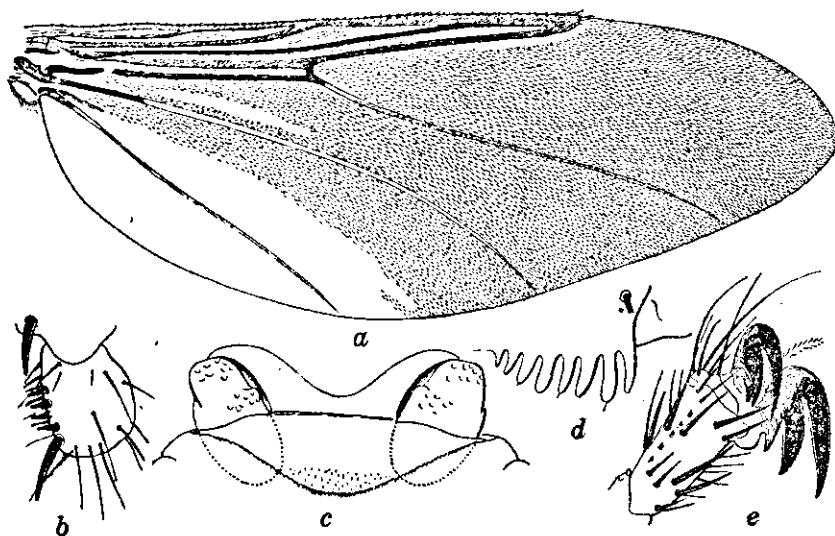


FIG. 3. *Lynchia maura* (Bigot); a, wing, to the same scale as fig. 2; b, first segment of middle tarsus; c, clypeal region of head; d, fringe at posterior lateral angle of scutellum; e, last segment of posterior tarsus.

sent but a single species. The only point of difference that I have been able to find and that may possibly have some significance is in the character of the setae on the plantar surface of the first tarsal segment on the second legs. In the Philippine specimen this area bears a number of short, stout, black setae (fig. 3, b), while in the European specimen there are here only small, slender setae. In all other respects there is complete agreement as far as the difference in sex will permit. It should be noted that there is but little sexual dimorphism in this genus.

As the species is described and quite well known, I shall content myself with these notes and the accompanying figures.

Genus ORNITHEZA Speiser

The distinctive characters of this genus are given as follows: Wings present, functional, noncaducous, with several veins behind the costa and with three "cross veins," an anal cell consequently present, the "third vein" (R_{4+5}) not confluent with the costa, the "second vein" (R_{2+3}) becoming confluent with the costa but slightly beyond the tip of the "first vein" (R_1). Ocelli present. Claws 3-toothed. In addition I would note the

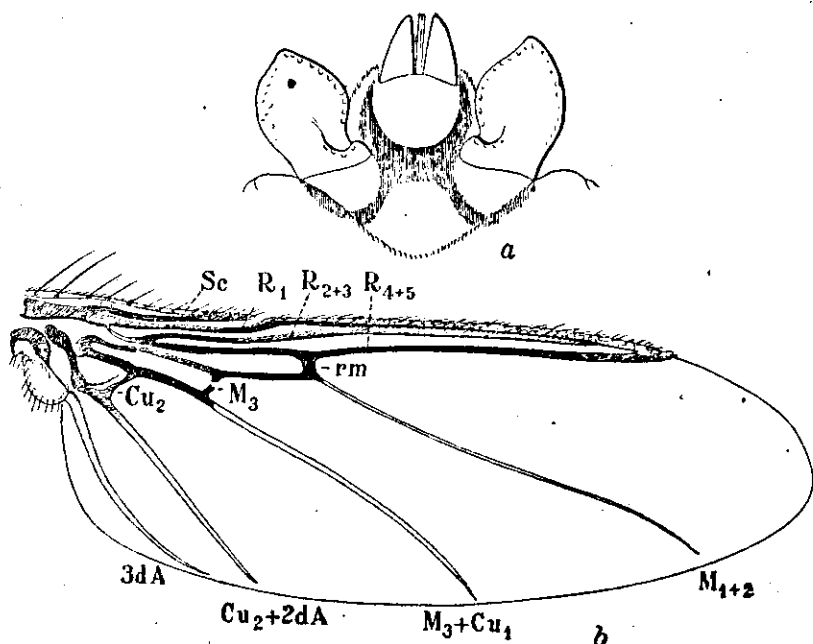


FIG. 4. *Ornitheza metallica* (Schiner); a, clypeal region of head; b, wing, to the same scale as fig. 5, venation according to Comstock-Needham system.

absence of a median, transversely striate area on the dorsum of the abdomen and of a transverse comb of setæ on the basal segment of the posterior tarsi. The presence of the last character is distinctive of the closely similar genus *Ornithotona*. The antennæ are broad and flat, somewhat divergent, and scarcely exceeded by the palpi.

Several species have been described in the genus, but the descriptions are for the most part very inadequate, being concerned chiefly with color. However, the species at hand may apparently be referred to a described form.

Ornitheza metallica (Schiner). Figs. 4 and 5.

Ornitheza metallica (Schiner), MASSONAT, Annales de L'Université de Lyon N. S. (1), 28 (1909) 290-295, pl. 1, figs. 11-12.

Previous records.—A European species, recorded from *Garulus glandarius* and *Ardea cinerea*.

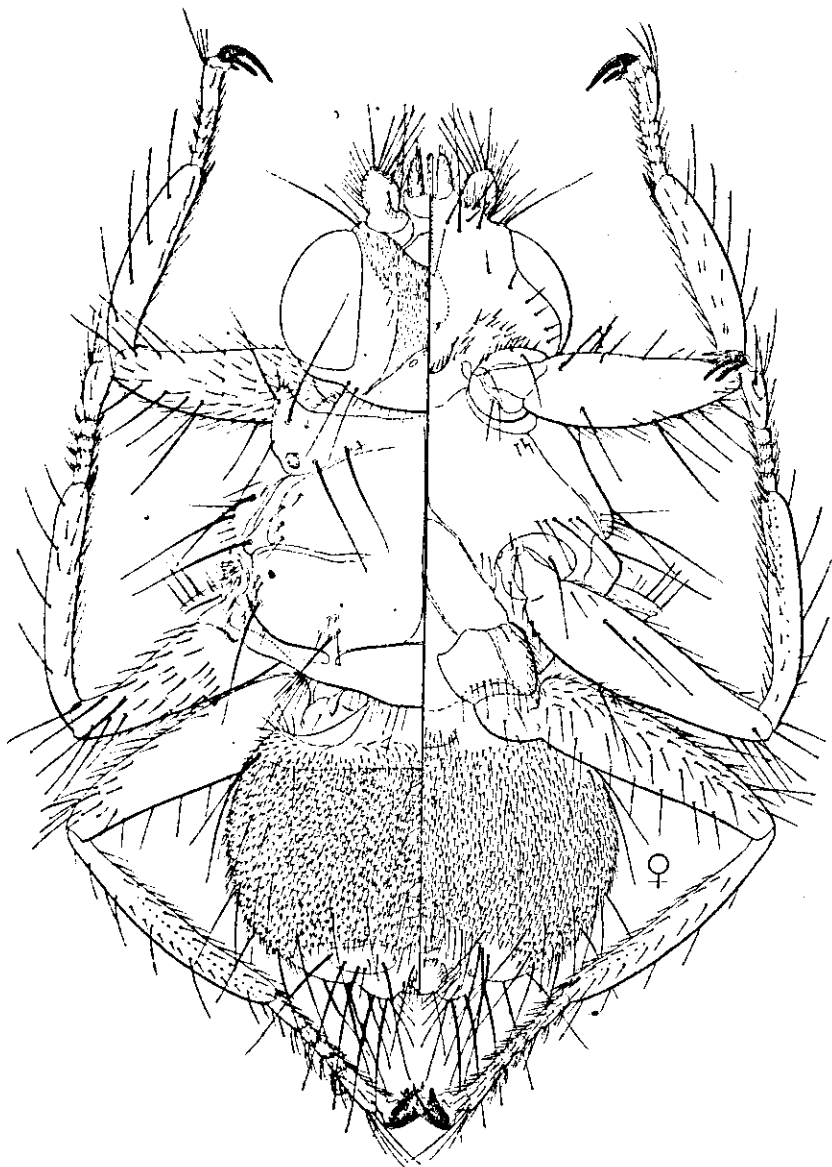


FIG. 5. *Ornitheza metallica* (Schiner); female, wings removed.

Material examined.—A single female from *Emberiza sulfurata*, Solsona, Luzon, December 16, 1923 (McGregor).

Notes.—The specimen at hand agrees very closely with the quite detailed description given by Massonat of *O. metallica* except for one slight difference: Massonat speaks of the presence of but two small, median plates on the dorsum of the abdomen, while in the specimen at hand there are three. It is entirely possible, however, that one of these might have been concealed beneath the basal plate, as frequently happens in contracted specimens; and, in view of the close resemblance in other respects, I am not inclined to separate the Philippine specimen.

Massonat has called attention to the peculiar character of the wings, there being an extra anal vein (fig. 4, *b*) which, according to the Comstock system, should be the third anal. This vein is apparently peculiar to this species. I would add the note that the wings are entirely destitute of minute setulæ and setæ are present only on the costa, those near the base being rather long. The claws are as in *Lynchia maura* and fig. 3, *e* will apply equally well to *O. metallica*.

The accompanying figures should make the recognition of the species possible, and I content myself with them and these notes.

ILLUSTRATIONS

TEXT FIGURES

- FIG. 1. *Cyclopodia horsfieldi* de Meijere; *a*, female, legs removed; *b*, anterior leg; *c*, halter; *d*, abdomen of male. All figures to the same scale.
2. *Lynchia maura* (Bigot); male, wings removed; from a Philippine specimen.
3. *Lynchia maura* (Bigot); *a*, wing, to the same scale as fig. 2; *b*, first segment of middle tarsus; *c*, clypeal region of head; *d*, fringe at posterior lateral angle of scutellum; *e*, last segment of posterior tarsus.
4. *Ornitheza metallica* (Schiner); *a*, clypeal region of head; *b*, wing, to the same scale as fig. 5, venation according to Comstock-Needham system.
5. *Ornitheza metallica* (Schiner); female, wings removed.

DIE TENEBRIONIDEN (COLEOPTERA) DES INDO-
MALAYISCHEN GEBIETES, UNTER BERUECKSICHTIG-
UNG DER BENACHBARTEN FAUNEN, VI

DIE GATTUNGEN ISCHNODACTYLUS, HOPLOCEPHALA, UND
MARTIANUS

Von HANS GEBIEN
Hamburg, Deutschland

ZWEI TAFELN

Genus ISCHNODACTYLUS Chevrolat

Ischnodactylus CHEVROLAT, Pet. Nouv. Ent. 2 (1877) 173.

Chevrolat, der Autor zahlreicher Diaperiden, hat auf diesem Gebiet leider viel gesündigt. Fast alle seine Beschreibungen sind unzureichend, enthalten nicht selten grobe Fehler, so dass er selbst genötigt war fortwährend Korrekturen zu geben. Auch bei unserer Gattung ist er unzuverlässig. In der Gattungsbeschreibung nennt er die Fühler 12-gliedrig, eine Art (*Ischnodactylus batesi*) soll 10-gliedrige Fühler haben. Sie sind aber weder 10- noch 12-gliedrig, sondern haben, wie alle Diaperiden, 11 Glieder.

Die Arten bieten in der Bewaffnung des Kopfes beim Männchen gute Merkmale. Einige Arten haben keine Hörner, meist dagegen sind zwei sehr lange, dünne, haarförmige, im Nacken entspringende Hörner vorhanden, die eng aneinander liegen. Solche Hornbildung kommt meines Wissens bei keinem Käfer wieder vor. Die Hörner sind entweder kahl, oder an der Spitze mit feinem Haarpinsel versehen, am Grunde dünn oder mit plötzlicher Verbreiterung. Die Zeichnung der Decken scheint sehr konstant zu sein wie bei den meisten Diaperiden. Die Decken sind entweder ungefleckt (*loripes*, *immaculatus*) oder mit zwei (*colon*, *rubromarginatus*), oder vier (*quadrioculatus*, *batesi*, *gradatus*, *mirabilis*) oder sechs Flecken versehen (*sexguttatus*, *bisetiger*), oder haben endlich vorn eine Querbinde (*sumbawicus*, *formosanus*, *unifasciatus*, *bisbifasciatus*). Chevrolat gibt als Gattungsmerkmal den stark aufgebogenen Clypeus an; leider trifft es nicht für alle Arten zu. *Ischnodactylus mirabilis*

und *I. batesi* haben ein dreieckig vorgezogenes Epistom, eine neue Art dort ein winziges Hörnchen, andere Arten einen gerade abgeschnittenen Vorderkopf dessen Wangen blattdünn sind. Wichtig für alle Arten ist die Bildung des hohen, sehr spitzen, seitlich scharf kompressen Prosternums. Der Körper ist im Gegensatz zu *Platydemia* immer auffallend flach. Abweichend von dem oft ähnlichen *Basanus* haben die Flügeldecken vollständige, am Ende nicht ausgeschnittene Epipleuren.

Da die Färbung sehr beständig ist, lässt sich eine Bestimmungstabelle in erster Linie auf das leicht nachzuprüfende Merkmal der Zeichnung aufbauen. Die wesentlichen Artmerkmale liegen allerdings in der Kopfbildung der Männchen.

Bestimmungstabelle für die Arten der Gattung Ischnodactylus.¹

- | | |
|---|---------------------------------|
| 1. Flügeldecken ungefleckt..... | 2. |
| Flügeldecken mit hellen Binden oder Flecken..... | 3. |
| 2. Körper oval, Hinterschienen des Männchens gerade, Kopf in diesem Geschlecht mit haarfeinen, parallelen Hörnern. (Sumatra und Borneo.) | <i>I. immaculatus</i> sp. nov. |
| Körper parallelseitig, Hinterschienen beim Männchen gekrümmt, Kopf ungehörnt (ex Lewis). (Japan.)..... | <i>I. loripes</i> Lewis. |
| 3. Flügeldecken wenigstens vorn mit Querbinde..... | 4. |
| Flügeldecken mit runden oder eckigen Flecken, nie mit Binden..... | 8. |
| 4. Die Decken nur mit einer Binde hinter der Basis, ein Spitzenfleck fehlt | 5. |
| Decken auch hinten mit Binde oder Fleck..... | 6. |
| 5. Die helle Binde ist viel schmaler als der schwarze Raum vor ihr, die mittleren Fühlerglieder sind kaum länger als breit, Stirnhörner des Männchens, von der Seite gesehen, S-förmig, zuerst der Stirn anliegend, unter den Hörnern auf der Stirn ist kein Längsfältchen. (Formosa.)..... | <i>I. formosanus</i> sp. nov. |
| Die helle Binde ist so breit wie der Raum vor ihr, die mittleren Fühlerglieder des Männchens sind fast doppelt so lang wie dick, Stirnhorn gerade nach vorn gerichtet, unter ihm zarte Längsfältchen. (Assam.)..... | <i>I. unifasciatus</i> sp. nov. |
| 6. Die vordere Binde erreicht den Rand und ist stark gezackt, die hintere geht vom Rand schräg nach vorn und innen; 8 bis 10 Millimeter gross. Zwischenräume ganz flach, auch aussen; Männchen ungehörnt. (Malacca und Sumatra.)..... | <i>I. pictipennis</i> sp. nov. |
| Die vordere Binde erreicht selten den Rand und ist dann sehr breit, die hintere ist fleckenförmig, quer, nicht nach vorn gezogen und lässt den Rand ganz frei; Männchen gehörnt (auch bei <i>I. sumbawicus</i> ?)..... | 7. |
| 7. Zwischenräume vollkommen flach, vorderer Fleck viel breiter als der Rand vor ihm, auf acht Zwischenräumen vorhanden, Vorderkopf des Weibchens halbkreisförmig, hinterer Fleck quadratisch. (Sumbawa.)..... | <i>I. sumbawicus</i> sp. nov. |

¹*Ischnodactylus tetradymus* Fairmaire von Zanzibar ist ein *Peltoides*.

- Zwischenräume an der Seite und alle an der Spitze stark gewölbt, vorderer Fleck schmaler, fünf Zwischenräume einnehmend, hinterer bindenartig, schräg. Vorderkopf beim Weibchen mit gerade abgestutztem Epistom. (Formosa.)..... *I. bisbifasciatus* sp. nov.
8. Jede Decke nur mit einem Fleck im ersten Drittel..... 9.
Die Flügeldecken auch hinten gefleckt..... 11.
9. Kopf mit scharfen und schmalen Augenfurchen, der Fleck viel grösser als der dunkle Raum an der Basis vor ihm. Flügeldecken flach, an den Seiten tief gefurcht, die Seiten nahezu parallel. (Philippinen.)..... *I. bimaculatus* sp. nov.
Kopf ohne Augenfurchen, Flecken kleiner als der dunkle Raum vor ihm an der Basis oder ebenso gross; Flügeldecken von den Schultern an nach hinten etwas erweitert und im ersten Drittel sehr stumpf gewinkelt 10.
10. Körper auffallend flach, Decken an den Seiten tief gefurcht, der verflachte Rand hinten verbreitert, nicht hell. Fleck klein, Hörner des Männchens sehr lang, ausserordentlich stark gekrümmt, am Grunde scharf und plötzlich erweitert, circa 7 Millimeter gross. (Borneo und Sumatra.)..... *I. colon* sp. nov.
Körper gewölbter, Decken aussen nicht gefurcht, der verflachte Seitenrand hinten nicht verbreitert, hell gefärbt, Flecken gross, Hörner des Männchens kurz, gerade, mit ebenso langen, äusserst zarten Haarbüscheln an der Spitze, welche die Hörner fortsetzen, am Grunde nicht verbreitert, circa 5 Millimeter lang. (Malacca und Sumatra.)..... *I. rubromarginatus* Chevrolat.
11. Jede Decke mit zwei Flecken..... 12.
Jede Decke mit drei Flecken (der dritte, sehr kleine Fleck liegt entweder an der Schulter oder hart neben dem vorderen)..... 19.
12. Vorderkopf lang, seine Ränder aufgebogen, Epistom beim Männchen vorgezogen, meist dreieckig. Körper sehr flach, Halsschildseiten ganz verflacht 13.
Vorderkopf kurz, seine Ränder nicht aufgebogen, Epistom gerade abgestutzt, Hörner des Männchens am Grunde verbreitert, Körper gewölbt, besonders an den Seiten des Halsschildes. (Sumatra.)
I. gradatus sp. nov.
13. Flügeldecken an den Seiten gefurcht, Männchen meist mit zwei sehr langen, dünnen, am Grunde dem Kopf anliegenden Hörnern..... 14.
Flügeldecken an den Seiten nicht gefurcht, Männchen ungehörnt.. 17.
14. Kopf des Männchens ungehörnt; Flecken der Flügeldecken dunkel blutrot, Epistom des Männchens gerade abgestutzt mit kleiner, dreieckiger Spitze. (Philippinen.)..... *I. bakeri* sp. nov.
Kopf des Männchens gehörnt, Flecken der Flügeldecken gelblichrot, Epistom des Männchens mit Horn oder einfach stark dreieckig vorgezogen 15.
15. Der vordere Fleck nimmt ungefähr fünf Zwischenräume ein, Epistom des Männchens in der Mitte mit spitzem, wagerechten Horn, ausserdem finden sich im Nacken zwei Hörner. (Philippinen.).. *I. nasutus* sp. nov.
Der vordere Fleck hat nur die Breite von zwei bis drei Zwischenräumen, Epistom des Männchens höchstens dreieckig vorgezogen..... 16.

16. Vorderer Fleck quer, viel schmaler als der Raum vor ihm, die äusseren Reihen tief gefurcht, Fühlerglieder beim Männchen quer, Körper glänzend schwarz. (Insel Simalur.)..... *I. mirabilis* Gebien.
 Vorderer Fleck rund, so breit wie die dunkle Basis vor ihm, die äusseren Streifen schwach gefurcht, die mittleren Fühlerglieder beim Männchen so breit wie lang, Körper hellbraun. (Borneo.)
I. trigonalis sp. nov.
17. Die Flecken der Flügeldecken von ausserordentlicher Grösse, der vordere lässt nur den Nahtstreif und den äussersten frei, der Spitzenfleck nimmt die ganze Spitze ein. Halsschild querüber bis zum Seitenrand gewölbt, Vorderkopf stark verkürzt. (Philippinen.)
I. fenestratus sp. nov.
- Die Flecken viel kleiner, der vordere höchstens so breit wie vier bis fünf Zwischenräume, der hintere rings vom schwarzen Grunde umgeben. Halsschild an den Seiten ganz flach gedrückt..... 18.
18. Flecken sehr gross, der vordere nimmt mindestens die Breite von vier Zwischenräumen ein, Fühlerglieder so breit wie lang, das Epistom des Männchens ist stark aufgebogen, aber nicht dreieckig vorgezogen, die Stirn in diesem Geschlecht mit zwei Längsfältchen. (Java.)..... *I. quadrioculatus* Chevrolat.
- Flecken viel kleiner, der vordere höchstens von der Breite dreier Zwischenräume. Fühlerglieder deutlich quer, das Epistom des Männchens ist dreieckig vorgezogen, Stirn nur einfach gefurcht. (Sumatra.)..... *I. batesi* Chevrolat.
19. Der vordere Fleck ist doppelt. Männchen mit zwei Tuberkeln im Nacken und aufgesetzter Spitze am Clypeus. (Sumatra.)
I. sexguttatus sp. nov.
- Der vordere Fleck ist einfach, der dritte liegt an der Schulter. Männchen mit haarförmigen, langen Hörnern im Nacken und gerade abgesetztem Clypeus. (Sumatra.)..... *I. bisetiger* sp. nov.

Ischnodactylus immaculatus sp. nov.

Flach, ziemlich lang oval. Oberseite schwarz, oder schwarzbraun, ungefleckt, Rand der Decken, Fühler, Beine, und Unterseite hellbraun.

Der Kopf ist stark quer und hat stark vorquellende Augen, die innen fast eckig gegeneinander stossen, der Abstand ist ein Viertel so breit wie ein Auge und beim Männchen breit vertieft, also nicht gefurcht, beim Weibchen flach, kräftig punktiert. Die Wangen sind geradlinig schnell verengt, das Epistom ist gerade abgestutzt, vor den Augen findet sich eine kräftige Vertiefung, aber weder der Seitenrand noch das Epistom sind aufgebogen. Eine Clypealnaht fehlt, der Clypeus ist fein punktiert. Die Hornbildung des Männchens ist ähnlich wie bei *colon*, die Hörner sind dünn, riemenförmig, hinten nicht ganz senkrecht auf den Kopf gesetzt, sondern mit deutlicher Neigung nach vorn, dementsprechend ist die Biegung keine ganz halbkreisförmige,

am Grunde findet sich keine Verbreiterung, sondern die Hörner sind parallel, am Ende findet sich ein feiner, langer Pinsel. Die Fühler sind gelbrot, Glied 3 ist so lang wie 4, dieses ist länger, aber nicht viel schmaler als die folgenden Glieder, die rundlich sind und fast so breit wie lang. Das Kinn des Männchens hat eine rundliche, am Grunde flache Grube mit feinen Haarbüschel.

Der Halsschild ist dreimal so breit wie in der Mittellinie lang, der basale Mittellappen ist klein, wenig weit nach hinten gezogen. Von oben gesehen ist der Vorderrand sehr schwach ausgeschnitten, sehr fein, aber vollständig gerandet, es sind nur die beiden basalen Grübchen vorhanden, Seitengruben sind höchstens schwach angedeutet. Die Punktierung ist oberflächlich und sehr fein.

Die Flügeldecken sind ungefleckt, nur ist zuweilen die Naht hinten heller. Die Zwischenräume sind gleichbreit, die inneren ganz flach, die äusseren und alle an der Spitze stark gewölbt wie bei den meisten andern Arten.

Das Prosternum, die Mitte der Hinterbrust ganz hinten, das erste Abdominalsegment sind beim Männchen sehr fein, goldgelb, undeutlich behaart. Die Punktierung der Zwischenräume ist nur bei starker Vergrösserung erkennbar. An den Hintertarsen ist Glied 1 viel kürzer als der Rest.

Länge, 5.2 bis 6.9 Millimeter; Breite, 3 bis 3.4.

Vierundzwanzig Exemplare in den Sammlungen Stettin, München, und Gebien.

Sumatra, Soekaranda (*Dohrn*); Liangagas (*Dohrn*). Borneo, Sarawak, Ophir (*Wallace*).

Diese Art ist von allen andern Arten der Sunda Inseln durch die ungefleckten Flügeldecken zu unterscheiden. Dasselbe Merkmal zeigt auch *I. loripes* Lewis aus Japan, eine Art die ich nicht kenne, und die möglicherweise garnicht zur Gattung gehört, denn der Körper ist parallelseitig, das Männchen ist ungehörnt und hat gekrümmte Hinterschienen, ein Kennzeichen das bei keiner andern Art vorkommt, überdies sind die ganzen Decken punktiert gestreift. In der Hornbildung kommt unsere Art dem *I. colon* am nächsten, aber es fehlt die seitliche Verbreiterung der Hörner im ersten Viertel. Ganz gleich ist aber die Hornbildung bei *I. mirabilis* (denn die Kreuzung der Hörner bei *mirabilis* ist vielleicht individuell), nur dass bei dieser Art die Hörner zuerst dem Kopf anliegen, sich dann erheben, ohne sich stark bogig nach unten zu senken, auch fehlt das Haarbüschel am Ende, überdies ist *mirabilis* auf den Decken gefleckt.

Ischnodactylus loripes Lewis.

Ischnodactylus loripes LEWIS, Ann. & Mag. Nat. Hist. VI 13 (1894)
392, pl. 13, fig. 6, Männchen.

Diese Art ist mir unbekannt geblieben. Ich kann also auch nicht sicher angeben ob sie wirklich zur Gattung gehört. Die ganz abweichende, parallele, an die *Diaclina*-Arten erinnernde Gestalt, der einfache, ungehörnte, nicht vorgezogene Kopf, und die Form der Hinterbeine des Männchens sind ganz abweichende Charaktere.

Japan, Oyayama.

Ischnodactylus colon sp. nov. Tafel 1, Fig. 1 und 2.

Oval, sehr flach, glänzend schwarz, Unterseite und Beine schwarzbraun, die beiden ersten Fühlerglieder, die Hörner, und die Flecken der Decken gelbrot.

Der Kopf ist stark quer, die Augen quellen stark vor, ihr Innenrand ist breit verrundet, die Stirn zwischen ihnen nur ungefähr ein Viertel so breit wie ein Auge von oben gesehen, beim Männchen der Länge nach tief eingedrückt und fast glatt, beim Weibchen deutlich, wenn auch flach punktiert. Die Clypealnaht ist dicht ans Auge gerückt, gut ausgeprägt, der Vorderkopf ist kurz, aber viel länger als die Stirn zwischen den Augen. Die Wangen verengen sich schnell und geradlinig, sie sind vor den Augen tief eingedrückt, aber ihr Rand ist nicht aufgebogen, das Epistom ist schwach gewölbt, gerade abgeschnitten. Beim Männchen entspringen im Nacken zwei sehr dünne, ausserordentlich lange Hörner, die dem Hinterkopf am Grunde senkrecht aufgesetzt sind, von der Seite gesehen einen Halbkreis oder mehr bilden und mit dem Ende sich dem Epistom nähern oder es berühren. Dieses Ende trägt, so fein es auch ist, ein längeres Büschelchen gelber Haare. Die Hörner sind riemenförmig, der Grundteil ist scharfeckig verbreitert abgesetzt, aber ebenfalls parallelseitig. Die Fühler sind bis auf das erste oder die beiden ersten Glieder schwarz, Glied 3 gleich 4, doch ist dieses etwas breiter, die folgenden sind verrundet, ungefähr so breit wie lang, Glied 11 ist ziemlich lang oval. Das Mentum hat beim Männchen eine schwach quere, vorn scharf begrenzte, am Grunde flache Grube, die ein Haarbüschel trägt.

Das Pronotum ist fast dreimal so breit wie lang, es hat nur die beiden basalen Grübchen, die Seiten sind flach, in der Endhälfte parallel, dann nach vorn in kräftigem Bogen verengt, die Vorderecken sind breit verrundet, die Randung ist dort sehr

fein, aber vollständig. Die Punktierung ist sehr fein und oberflächlich, ziemlich dicht.

Die Flügeldecken haben einen sehr schwach durchscheinenden Rand, sie sind hinter der Schulter leicht gerundet erweitert, dann wieder verengt, der Seitenrand ist verflacht abgesetzt und nach hinten deutlich verbreitert. Es sind Reihen äusserst fein eingestochener, dichtstehender Punkte vorhanden, die inneren Zwischenräume sind ganz flach, die äusseren stark gewölbt, unpunktiert. Es ist auf jeder Decke nur ein gelber Fleck vorhanden, welcher ziemlich kreisrund ist, von dem Durchmesser wie der Raum vor dem Fleck bis zur Basis, er nimmt den vierten und fünften Zwischenraum ganz ein, greift aber auch leicht auf den dritten und sechsten über; die Zwischenräume sind dort nicht verbreitert.

Das Prosternum ist beim Männchen sehr fein und dicht punktiert und gelb, unauffällig behaart, auch das erste Abdominalsegment zeigt leichte Behaarung und auf dem Metasternum findet sich hinten jederseits der Mitte ein Porenpunkt mit je einem sehr feinen, anliegenden Haarbüschelchen. An den Hintertarsen ist Glied 1 nur wenig kürzer als der Rest; 4 gleicht 2 + 3, 3 gleicht der Hälfte des zweiten, 2 gleicht der Hälfte des ersten.

Länge, 6.6 bis 6.9 Millimeter; Breite, 3.5 bis 3.8.

Vier Männchen und 5 Weibchen in den Sammlungen Stettin, München, und Gebien.

Sumatra, Soekaranda (*Dohrn*); Bekantiang (*Dohrn*). Borneo, Sarawak (*Wallace*).

Von allen Arten ausser *rubromarginatus* durch nur zwei Flecken auf den Flügeldecken verschieden. Auch die Anordnung der Haare auf der Unterseite und die eigentümliche Hornbildung der Männchen sind gute Merkmale.

Ischnodactylus rubromarginatus Chevrolat. Tafel 1, Fig. 3.

Ischnodactylus rubromarginatus CHEVROLAT, Pet. Nouv. Ent. 2 (1877) 242.

Klein, oval, ziemlich gewölbt, schwarz glänzend, die ersten drei Fühlerglieder, die Beine, und der Rand der Decken rotbraun, die Flecken gelblich.

Der Kopf ist ausserordentlich stark quer, fast doppelt so breit wie lang, die Stirn ist vorn nur halb so breit wie ein Auge, diese sind schräg nach innen gerichtet, vorn am nächsten, das sehr schmale Epistom ist nicht länger als die Stirn vorn. Die Sei-

ten des Kopfes sind nach vorn sehr stark verengt, der Clypeusrand ist gerade, nicht aufgebogen, sondern etwas gewölbt, die Clypealnaht liegt dem Auge hart an. Beim Männchen finden sich im Nacken zwei gerade, riemenförmige, direkt nach vorn gerichtete Hörner, die an der Spitze ein Pinselchen sehr langer Haare tragen, die als solche nur unter starker Vergrösserung erkennbar sind, da sie nur eine Verlängerung der Hörner bilden. Die Stirn unter den Hörnern ist breit grubig vertieft, die Oberfläche beim Männchen fast glatt, beim Weibchen deutlich punktiert. Die Fühler sind dick, glänzend, Glied 4 ist so lang wie 3, so breit wie lang, kaum schmaler als die folgenden, die andern Glieder sind 1.5 mal so breit wie lang, und haben kaum verrundete obere Ecken. Das Mentum des Männchens hat eine flache Grube mit einem kaum sichtbaren Haarpinselchen.

Der Halsschild ist über doppelt so breit wie lang, verhältnismässig stark gewölbt, besonders an den Seiten nicht verflacht, die Seitenränder sind kräftig gerundet, der Vorderrand ist gerade abgestutzt, die Hinterecken sind stumpfwinklig, die Punktierung ist fein, aber sehr deutlich, mässig dicht, es sind nur die basalen Eindrücke vorhanden.

Die Flügeldecken sind ziemlich gewölbt, sie haben Reihen zwar sehr feiner, aber doch viel deutlicherer Punkte als bei den ganz flachen Arten, die Zwischenräume sind vollkommen flach, nur die äusseren leicht gewölbt, der Rand ist vorn sehr schmal, hinten viel breiter verflacht. Jede Decke hat nur vorn einen grossen, runden, gelben Fleck, der breiter ist als der Raum vor ihm, er nimmt die Zwischenräume 3, 4, und 5 ganz ein, meist auch 6 und den grössten Teil von 2. Der dritte und fünfte Zwischenraum sind dort nur wenig verbreitert.

Die Unterseite hat auch beim Männchen keine Behaarung. An den Hintertarsen ist Glied 1 wesentlich kürzer als der Rest. Länge, 4.3 bis 6.2 Millimeter; Breite, 2.5 bis 3.4.

Fünf Männchen und 24 Weibchen in den Sammlungen Berlin, Stettin, München, und Gebien.

Sumatra, Soekaranda, Januar, 1894 (*Dohrn*); Liangagas (*Dohrn*); Ober Langkat, Deli (*Reinsch*). Malacca, Perak (*Jachau*). Penang.

Diese Art hat wie *I. colon* nur zwei Flecke auf den Decken, die aber viel grösser sind, auch ist *colon* viel flacher und hat aussen gefurchte Decken. Ferner ist die Bewaffnung des Kopfes beim Männchen ganz anders.

Die Type Chevrolat's in der ehemaligen Sammlung Haag in München ist ein Weibchen. Chevrolat glaubt dass diese Art mit *Platydemia* (*Histeropsis*) *quadrispilotum* zusammenfällt, und das Weibchen von ihm sei. Das ist ein grosser Irrtum, schon die Zeichnung ist ganz anders; auch hat diese Art ein einzelnes, gerades, dickes Horn auf dem Kopfe des Männchens.

Ischnodactylus gradatus sp. nov.

Lang oval, ziemlich gewölbt, glänzend schwarz, Fühler, Epipleuren, Hörner, Beine, and Flecken der Decken rot.

Der Kopf ist stark quer, aber nicht annähernd so stark wie bei voriger Art, vorn nur schwach verkürzt, die Augen sind innen fast eckig, die Stirn ist dort nur ein Drittel so breit wie ein Auge. Die Seiten des Vorderkopfes verengen sich sehr schnell und stark, das Epistom ist gerade abgestutzt, ganz flach, und geht unmerklich in die Gelenkhaut über. Die Wangen sind vor den Augen schwach vertieft. Die Hörner sind beim gut entwickelten Männchen zuerst ziemlich kräftig, fast senkrecht ansteigend, dann wagerecht über dem Kopf liegend, an der Spitze mit unscheinbarem Haarpinselchen versehen, das sehr kurz ist. Am Grunde sind die Hörner breit riemenförmig, dann plötzlich stufenförmig verengt und im weiteren Verlauf rund, bei einem andern Männchen dagegen ohne deutliche Stufe. Die Stirn unter den Hörnern ist muldig vertieft und mit einzelnen gröberen Punkten versehen. Die Fühlerglieder sind rundlich, so breit wie lang. Des Mentum hat eine schwache Grube mit einem undeutlichen Haarpinselchen.

Das Pronotum ist über 2.5 mal so breit wie lang, zwar flach aber an den Seiten doch kräftig abwärts gebogen und gewölbt, die Seitenränder sind stark gebogen, nach hinten fast etwas verengt, der Vorderrand ist gerade abgestutzt, die Vorderecken sind sehr breit verrundet, die Hinterecken sehr stumpf. Ausser den beiden basalen Grübchen findet sich kein weiterer Eindruck. Die Punktierung ist kaum sichtbar.

Die Flügeldecken sind flach, mit sehr feinen Punktreihen oder Streifen versehen, deren Punkte aber viel deutlicher als bei den meisten andern Arten sind, die inneren Zwischenräume sind ganz flach, auf den Flecken nicht verbreitert, die äusseren kräftig gewölbt. Der Rand und die Spitze der Decken sind bräunlich durchscheinend. Jede Decke hat zwei grosse, runde Flecke: der vordere im ersten Drittel ist ungefähr so breit wie der Raum zwischen ihm und der Basis, er nimmt die Zwischenräume 3 bis

6 ganz ein und die Hälfte von 2. Der hintere Fleck ist ebenfalls kreisrund, aber mehr verwaschen und etwas kleiner als der vordere.

Die Unterseite ist beim Männchen auf dem Prosternum, dem Metasternum hinten, und den ersten Abdominalsegmenten ganz leicht behaart. An den Hintertarsen ist Glied 1 länger als 4.

Länge, 4.8 bis 5.2 Millimeter; Breite, 2.8 bis 3.

Drei Männchen, davon eines mit abgebrochenen Hörnern, im Museum Stettin, von denen mir eines für meine Sammlung überlassen wurde.

Sumatra, Soekaranda (*Dohrn*); Liangagas (*Dohrn*).

Der verhältnismässig kräftig gewölbte Körper weist dieser Art einen Platz an neben *I. rubromarginatus*, von dem sie sich durch die Färbung (zwei statt eines Fleckens) und die Kopfbildung des Männchens sicher unterscheidet. Vier Flecken hat ebenfalls *I. batesi*, ist aber grösser, sehr flach, die Flecken sind klein, der Kopf ganz anders. Auch *I. quadrioculatus* ist weit entfernt.

Ischnodactylus mirabilis Gebien. Tafel 1, Fig. 4 und 5. °

Ischnodactylus mirabilis GEBIEN, Notes Leyd. Mus. 36 (1914) 64.

Von dieser Art liegt mir auch jetzt ausser den beiden Typen (Männchen, Weibchen) kein weiteres Material vor. Der ausführlichen Beschreibung an andern Ort ist nichts hinzuzufügen. Ueber die Verwandtschaftsbeziehungen zu *I. batesi* und *I. sexguttatus* wird dort berichtet.

Simalur, Sinabang, Juli, 1913 (*Jacobson*).

Ischnodactylus batesi Chevrolat. Tafel 1, Fig. 6.

Ischnodactylus batesi CHEVROLAT, Bull. Soc. Ent. France (1879) LXXXVIII.

Diese Art ist etwas grösser als die vorige, im übrigen ihr aber ähnlich, die Flügeldecken sind jedoch an den Seiten fast einfach gestreift punktiert, bei *mirabilis* tief gefurcht, ebenso an der Spitze; der vordere Fleck liegt bei *batesi* vor, bei *mirabilis* im ersten Drittel, ist bei letzterer Art quer, bei *batesi* ganz rund.

Unter den 10 mir vorliegenden Tieren sind 4 Männchen, aber nur eines hat die charakteristischen Hörner, sie sind dünn, und wie bei *mirabilis* gestaltet, am Ende also nackt; die anderen 3 Männchen (durch dreieckig vorgezogenen, stark aufgebogenen Clypeus vom Weibchen unterschieden) haben keine Spur von Horn. Ich finde bei keiner andern Art etwas ähnliches. Wohl finden sich, wie bei allen gehörnten Käfern, graduelle Unterschiede in der Entwicklung der Hörner; aber der unvermittelte

Gegensatz zwischen vorzüglich entwickelten Hörnern und deren gänzlich Fehlen bei unserer Art ist sehr auffällig. Weiteres Material muss zeigen ob sich Uebergänge finden oder ob bei den Männchen zwei Rassen angenommen werden müssen. Beim Weibchen, das einen abgestutzten Clypeus hat, finden sich ganz im Nacken zwei stark genäherte Körnchen statt der Hörner, sind aber meist unter dem Vorderrand des Halsschildes verborgen.

Vier Männchen und 6 Weibchen, in den Sammlungen Stettin und Gebien.

Sumatra, Soekaranda (*Dohrn*); Liangagas (*Dohrn*).

Ischnodactylus trigonalis sp. nov.

Flach, braun, glänzend.

Der Kopf ist beim Weibchen stark quer, beim Männchen so breit wie lang, die Augen treten stark, fast konisch vor, von ihnen an ist der Kopf beim Männchen stark spitzbogig dreieckig verengt, das Epistom ist stark aufgebogen, hat aber im vorderen Winkel keine aufgesetzte Spitze. Die Stirn ist hinten breit muldig vertieft. Die Hörner des Männchens sind dünn, lang, liegen zuerst der Stirn an und sind dort verflacht, sie steigen dann senkrecht aufwärts, die Hörner sind an den Seiten nicht verbreitert abgesetzt, sondern schlank, am Ende fehlt ein Haarbüschel. Der ganze Vorderkopf ist stark vertieft, beim Weibchen ist sein Rand von Auge zu Auge halbkreisförmig und kräftig aufgebogen. In beiden Geschlechtern ist die halbkreisförmige Querfurche gut ausgeprägt, beim Weibchen hat die Stirn hinten zwei eng aneinander liegende Tuberkeln. Die Fühler sind schlank, Glied 3 gleich 4, die folgenden sind beim Männchen so breit wie lang, fast kugelig, aber flach, beim Weibchen deutlich quer. Das Kinn des Männchens mit der gewöhnlichen, mit Haarpinsel versehenen Grube.

Der Halsschild ist sehr flach, die Seiten sind etwas flachgedrückt, an der Basis finden sich die gewöhnlichen zwei Gruben, die Seiten sind in der Endhälfte fast parallel, die Vorderecken sind stumpfwinklig und an der äussersten Ecke kaum verrundet, die hinteren scharf, fast rechtwinklig, beim Männchen ist der Vorderrand kräftig ausgeschnitten.

Die Flügeldecken sind flach, der Seitenrand ist hinten nicht deutlich breiter. Die Punkte der Reihen sind recht kräftig, die seitlichen Streifen sind furchig vertieft, die Zwischenräume an der Spitze stärker gewölbt. Jede Decke hat zwei runde, ziemlich grosse Flecken, beide ungefähr von der Grösse zweier Zwi-

schenräume, der vordere hat einen so grossen Durchmesser wie sein Abstand von der Basis. Der fünfte Zwischenraum ist auf dem Fleck verbreitert. An den Hintertarsen ist Glied 1 kürzer als der Rest.

Länge, 6.2 bis 7.8 Millimeter; Breite, 3.3 bis 4.

Ein Pärchen von Borneo, Sarawak (*Doria* leg.) im Museum Berlin.

Aus der Beschreibung geht die nahe Verwandtschaft dieser Art mit *I. mirabilis* hervor. Wenn nicht bei unserer Gattung die Zeichnung sehr konstant wäre, würde ich geneigt sein vorstehende Art als ausgeprägte Lokalrasse von *I. mirabilis* anzusehen. Aber die Zeichnung ist abweichend; der vordere Fleck ist nicht quer, sondern rund und so gross wie der Raum vor ihm. Ferner sind die äusseren Zwischenräume schwach gefurcht, die Fühlerglieder des Männchens nicht quer, sondern so breit wie lang, beim Weibchen quer; ausserdem ist die Färbung nicht ein glänzendes Schwarz, sondern ziemlich hell braun.

Ischnodactylus nasutus sp. nov. Tafel 1, Fig. 7.

Gross, sehr flach, glänzend schwarz, Flügeldecken mit je zwei hellen Flecken, Schenkel mehr oder minder braun oder gelbbraun, Epipleuren, oft auch die Hüften und Ränder des Kopfes braun.

Der Kopf hat schräg nach vorn gerichtete Augen, die sich vorn bis auf einen Zwischenraum nähern, kaum grösser als das dritte Fühlerglied lang. Die Stirn ist in beiden Geschlechtern der Länge nach eingedrückt, hinten finden sich beim Weibchen zwei genäherte rundliche Körner, beim Männchen zwei lange, steil aufgesetzte, etwas nach hinten gerichtete Hörner. Diese sind schmal, parallelseitig, riemenförmig, also von vorn nach hinten flach gedrückt, nicht sehr spitz, und haben am Ende keinen Haarschopf; von der Seite gesehen erscheinen sie leicht nach vorn gebogen. Der Vorderkopf ist stark entwickelt, die Ränder sind breit aufgebogen, das Epistom ist gerade abgeschnitten, aber in beiden Geschlechtern in der Mitte ausgezeichnet. Beim Männchen findet sich dort ein ziemlich langes, wagerecht nach vorn vorgezogenes, seitlich kompresses Horn, dessen Oberkante kielförmig ist. Von der Seite gesehen ist dieses Horn ganz wagerecht, etwas dreieckig, und geht hinten direkt in den hinteren Teil des Epistoms über. Beim Weibchen findet sich an derselben Stelle eine mehr oder minder spitze Tuberkel. Die Ecken des Epistoms sind in beiden Geschlechtern, beim Männchen mehr, kräftig grubig eingedrückt. Die Clypealsutur ist

halbkreisförmig, gut eingeschnitten, die Punktierung kaum wahrnehmbar fein. Die Fühler sind in beiden Geschlechtern ziemlich gleich, beim Männchen ist das vierte Glied wesentlich länger als an der Spitze breit, beim Männchen nur schwach länger, oder so breit wie lang, die folgenden sind beim Männchen fast kugelig, so breit wie lang, beim Weibchen etwas quer; das letzte Glied hat eine helle Spitze. Das Mentum hat beim Männchen eine fast kreisförmige, am Grunde flache Grube ohne starken Rand, in der Mitte mit winzigem Haarbüschelchen.

Der Halsschild ist sehr flach, an der Basis reichlich 2.5 mal so breit wie in der Mittellinie lang. Die Seiten sind ganz verflacht und haben eine äusserst feine Randlinie. Die Linie an der sanft ausgeschnittenen Spitze ist vollständig, die Seiten sind in der Endhälfte parallel, die Vorderecken ziemlich breit verrundet, die Basiswinkel scharf, aber stumpf. An den Seiten findet sich eine flache, undeutliche Grube, die basalen Eindrücke sind recht tief und deutlich. Die Punktierung ist ausserordentlich fein und nicht dicht, beim Weibchen nur unter sehr starker Vergrösserung sichtbar; dem schwach bewaffneten Auge erscheint die Oberfläche glatt.

Die Flügeldecken sind sehr flach, sie haben je zwei sehr grosse Flecke, von denen der vordere schwach quer und etwas schräge zur Schulter gerichtet ist, viel breiter als der Raum an der Basis vor ihm, sein Vorderrand ist nicht gezackt, der Hinterrand etwas uneben; der Fleck lässt nur den Nahtstreif und die beiden äusseren Zwischenräume ganz, den zweiten zur Hälfte frei. Der Spitzenfleck ist fast kreisrund und nimmt die Streifen 4 bis 6 ein. Die Zwischenräume 3 und 5 sind auf dem vorderen Fleck mässig stark verbreitert. Auf der Scheibe sind alle Zwischenräume vollkommen flach, die Punktlinien sehr fein, nicht eingeschnitten; die seitlichen dagegen bilden Furchen, aber schwächer als bei vielen andern Arten, dort sind die Interstitien ebenso wie an der Spitze gewölbt. Die Unterseite zeigt beim Männchen nur in der mittleren Längslinie Spuren von Behaarung.

Länge, 6.3 bis 7.8 Millimeter; Breite, 3.3 bis 3.9.

Zwei Männchen und 1 Weibchen in meiner Sammlung, 2 Weibchen in der des Britischen Museums.

Philippinen, Basilan; Mindanao, Iligan; Mindanao, Kolambugan (*Baker leg.*).

Die Stücke wurden von Herrn Professor Baker unter den Nummern 11651, 14100, und 14110 mitgeteilt.

Diese Art erinnert wegen der grossen Flecke an *I. quadrioculatus*, hat aber andere Zeichnung, fast glatten Halsschild, und ganz andere Kopfbildung der Männchen. Dieses hat nämlich zwei lange Nackenhörner und ein Clypealhorn, die der alten Art fehlen; ausserdem sind die Flügeldecken an den Seiten tief gefurcht.

Ischnodactylus fenestratus sp. nov. Tafel 1, Fig. 8.

Mässig flach, glänzend braunschwarz, Flügeldecken mit je zwei sehr grossen Flecken; Unterseite, Beine, und Fühler gelbbraun.

Kopf zwischen den Augen nicht eingedrückt, beim Weibchen ohne Körner oder Hörnchen, die Stirn vorn etwas breiter als das dritte Fühlerglied lang, der sehr kurze Vorderkopf nicht länger als die Stirn vorn breit. Das Epistom hat kurz verrundete Ecken und ist vorn gerade, ohne jegliche Auszeichnung abgestutzt. Die Punktierung ist zwar sehr fein, aber deutlich. Die Fühler sind ganz hell, Glied 3 gleich 4, dieses etwas länger als breit, die folgenden sind gleich, schwach quer, das letzte ist birnförmig, 1.5 mal so lang wie breit. Das Mentum hat eine kreisrunde, scharf begrenzte Grube mit einem zentralen, starken Haarpinsel.

Der Halsschild ist von der Basis an nach vorn verengt, an den Seiten nicht verflacht, sondern die quere Wölbung geht bis an den Rand. Die Spitzenrandung ist in der Mitte unterbrochen, der Rand selbst, von oben gesehen, schwach ausgeschnitten. Die Punktierung ist sehr fein, aber auch bei schwacher Vergrösserung deutlich.

Die Flügeldecken haben je zwei grosse, gelbe Flecken; der vordere ist fast kreisförmig, über doppelt so breit wie der schwarze Saum an der Basis und viel breiter als die schwarze Querbinde der Decken hinter ihm; er reicht hinten bis zur Mitte der Decken und lässt an beiden Seiten nur den Nahtstreif und den Streif über dem Seitenrand frei. Der hintere Fleck nimmt die ganze Spitze ein, und nur der hinterste Teil und die Naht selbst bleiben dunkler. Die Punktlinien sind ausserordentlich fein, nur an der Spitze ganz leicht vertieft. Die Zwischenräume sind vollkommen flach, auch an den Seiten; der verflachte Seitenrand ist sehr schmal abgesetzt.

Länge, 5.5 Millimeter; Breite, 3.

Ein Weibchen von Borneo, Sandakan (*Baker*); ein Weibchen im Museum Leyden von Nordost Sumatra, Tandjong Morawa, Serdang (*Hagen*.)

Diese Art ist so grossfleckig wie keine andere. Bei dem ähnlich gezeichneten *I. sumbawicus* bildet der vordere Fleck eine breite Binde, übrigens ist bei dieser Art die Kopfbildung eine ganz andere als bei *I. fenestratus*. Eine gewisse Ähnlichkeit zeigt auch *I. quadrioculatus* von Java, ist aber grösser, hat kräftig vorragende Ecken des Pronotums, kleinere Flecke, und langen Vorderkopf.

Ischnodactylus bimaculatus sp. nov.

Diese Art ist neben *I. colon* zu stellen, mit welchem sie in allen wesentlichen Merkmalen übereinstimmt, doch ist sie kleiner. Fühler und Beine sind gelbrot, die Unterseite ist braun. Der einzelne Fleck jeder Decke ist gross, rund, und nimmt die Zwischenräume 3 bis 6 ganz ein, geht aber auch auf 2 und 7 über. Nur der fünfte Streif ist auf ihm leicht verbreitert. Der Fleck ist viel breiter als der schwarze Raum vor ihm. Die Decken sind nahezu parallelseitig; die stumpfwinklige Erweiterung vorn fehlt also. Ein weiterer scharfer Unterschied liegt in der Kopfbildung; es finden sich nämlich scharfe und lange wenn auch schmale Augenfurchen am Innenrande der Augen, welche dem *I. colon* fehlen. Von *I. rubromarginatus*, der in der Zeichnung ähnlich ist, unterscheidet sich unsere Art durch den flacheren Körper mit dunklem Rand, an den Seiten tief gefurchte Flügeldecken, viel breitere Hinterschienen.

Länge, 5.6 Millimeter; Breite, 2.9.

Ein Weibchen von den Philippinen, Mindanao, Kolambugan (*Baker*), in meiner Sammlung; ein Weibchen von Luzon, Mount Maquiling (*Baker*), im Museum Dresden.

Ischnodactylus bakeri sp. nov.

Flach, glänzend schwarz, Unterseite dunkelbraun, Fühler und Beine gelbbraun; Flügeldecken mit dunkel blutroten Flecken.

Der Kopf ist zwischen den Augen vorn schwach und nicht scharf eingedrückt, Nackenhörner fehlen dem Männchen, auch sind dort keine deutlichen Tuberkeln vorhanden. Die Stirn ist vorn kaum breiter als das dritte Fühlerglied lang. Der Vorderkopf ist kräftig entwickelt, beim Männchen aber nicht dreieckig vorgezogen, doch sind die Ränder in beiden Geschlechtern aufgebogen. Beim Männchen ist die Mitte des gerade abgestutzten Epistoms durch eine kurze, nicht auffällige, dreieckige Spitze markiert, beim Weibchen ist der Vorderrand gerade. Augenfurchen fehlen. Die Punktierung ist sehr deutlich und ziemlich dicht, die Clypealsutur ist scharf eingeschnitten. An

den Fühlern ist Glied 4 gleich 3, beim Weibchen etwas breiter als beim Männchen; die vorletzten Glieder sind so lang wie breit. Mentum beim Männchen mit dem normalen, etwas queren, scharf begrenzten Grübchen, das in der Mitte behaart ist.

Das Pronotum ist an den Seiten ganz verflacht und dort mit der Spur einer flachen Grube versehen, auch die basalen Grübchen sind recht deutlich. Die Punktierung ist zwar äusserst fein, aber unter der Lupe sehr deutlich. Die Spitze ist sehr fein und vollständig gerandet, von oben gesehen nicht deutlich ausgeschnitten, die Vorderecken sind breit verrundet, die hinteren ziemlich scharf rechtwinklig.

Die Flügeldecken haben blutrote, nicht sehr grosse Flecke, die wegen ihrer dunklen Farbe nicht sehr deutlich sind. Der vordere ist schwach quer und nimmt die Zwischenräume 3 bis 5 ganz, 2 und 6 zur Hälfte ein, die Zwischenräume 3 und 5 sind auf dem Fleck etwas verbreitert. Der hintere Fleck ist fast kreisrund, er nimmt die Interstitien 2 bis 4 ein. Der Seitenrand der Flügeldecken ist hinter der Schulter sehr schwach und stumpf, undeutlich gewinkelt. Alle Zwischenräume sind an der Spitze stark gewölbt, die Streifen tief gefurcht, an den Seiten sind die äussersten fünf Streifen furchig vertieft. Die Unterseite des Männchens ist nicht behaart. An den Hintertarsen ist Glied 1 viel kürzer als der Rest.

Länge, 6,5 bis 7 Millimeter; Breite, 3,2 bis 3,5.

Ein Pärchen von den Philippinen; Männchen von Mindanao, Kolambugan; Weibchen von Bukidnon, Tangkulan (*Baker leg.*).

Diese Art unterscheidet sich leicht von den andern beiden philippinischen Arten (*bimaculatus* und *nasutus*) durch ganz andere Kopfbildung und die Zeichnung; auch die an den Seiten tief gefurchten Flügeldecken sind ein gutes Kriterium, denn bei *I. nasutus* sind nur die äusseren drei Streifen tief gefurcht und die andern schwach. Näher noch steht *I. trigonalis* von Borneo, aber hier ist der ganze Vorderkopf dreieckig vorgezogen, bei unserer Art abgestutzt und die Mitte des Epistoms hat beim Männchen eine aufgesetzte Spitze, die Flecken sind bei unserer Art grösser und blutrot, die äusseren Streifen tief gefurcht, und dem Männchen fehlen die Hörner im Nacken.

Ischnodactylus sexguttatus sp. nov. Tafel 2, Fig. 1.

Sehr flach, oval, glänzend schwarzbraun, Unterseite rotbraun, Fühler, Mundteile, und Beine hell braun.

Der Kopf ist stark quer, die Augen quellen stark aus der Wölbung des Kopfes und sind im oberen Teil schräg nach vorn

gerichtet, die Stirn zwischen ihnen ist kaum halb so breit wie der obere Teil eines Auges, sie ist der Länge nach breit eingedrückt, nicht eigentlich gefurcht, hinten finden sich bei den beiden Männchen keine Hörner, sondern nur zwei genäherte Tuberkeln. Der Vorderkopf ist von den Wangen an halbkreisförmig mit geradem Epistom, dort in der Mitte kurz zapfenförmig vorspringend, nicht dreieckig. Die Wangen sind blattdünn, an den Seiten etwas aufgebogen, aber nicht vorn. Beim Weibchen fehlt das Zähnchen des Epistoms und die Stirn ist etwas breiter und deutlicher punktiert. Die Oberlippe ist quer gekielt. Die Fühler sind schlank, Glied 3 ist doppelt so lang wie dick, nicht länger als 4, dieses zur Spitze verdickt, aber viel länger als breit, die folgenden sind alle nach dem Ende zu rundlich erweitert, etwas länger als breit, das Endglied ist lang elliptisch. Das Kinn ist nach vorn sehr stark verbreitert, aber viel länger als breit mit verflachten Seitenlappen. Die Scheibe ist beim Weibchen fein begrenzt, beim Männchen mit starker Grube, die Behaarung trägt.

Der Halsschild ist auffallend flach, mit schmalem Basalmittelappen, die Spitze ist in breitem Bogen flach ausgerandet, mit feiner Randlinie versehen; ausser den beiden basalen Grübchen finden sich zwei sehr flache Eindrücke am Seitenrand, die Hinterecken sind stumpfwinklig, die Vorderecken breit verrundet.

Die Flügeldecken sind sehr flach, die Seiten nicht gleichmässig gerundet, hinter der Schulter am breitesten. Die Seiten sind etwas durchscheinend braun. Auf jeder Decke sind drei Flecken vorhanden: die vorderen beiden liegen nebeneinander im ersten Drittel im dritten und fünften Zwischenraum, der hintere Fleck liegt im letzten Drittel im dritten und vierten Zwischenraum, geht aber oft auch auf den zweiten über, die vorderen sind schwach länglich. Es sind Reihen äusserst dicht stehender, sehr feiner, eingestochener Punkte vorhanden. Die ersten Zwischenräume sind ganz flach, die äusseren kräftig gewölbt, der dritte und fünfte sind auf den vorderen Flecken leicht verbreitert. Alle Zwischenräume sind sehr fein und ziemlich dicht punktiert.

Die Unterseite ist auch beim Männchen nackt, weder auf dem Prosternum noch auf dem Abdomen finden sich Haarflecke. Das Prosternum ist hinten sehr spitz, das Mesosternum scharf V-förmig ausgeschnitten. Die Propleuren sind nicht deutlich längsgestrichelt, aber die Seiten des Abdomens. Die Hinterschenkel sind dreimal so lang wie dick. An den Hintertarsen ist Glied 1 so lang wie der Rest.

Länge, 6.8 bis 7.2 Millimeter; Breite, 3.5 bis 3.8.

Drei Männchen und 5 Weibchen in den Sammlungen Berlin, Stettin, Gebien, und München.

Sumatra, Soekaranda, Januar, 1894 (*Dohrn*); Ober Langkat, Deli (*Ude*); Tebing-tinggi, 17ten Januar, 1885 (*Schultheiss*). Borneo, Sandakan (*Baker*).

Diese Art ist dem *I. bisetiger* verwandt und hat wie diese Art sechs Flecken. Die vorderen liegen aber eng nebeneinander, bei *bisetiger* weit auseinander (der zweite an der Schulter). Die Kopfbildung des Männchens (das fehlende Stirnhorn, der gezähnte Clypeus) unterscheidet die Arten leicht. Das Weibchen ist von *I. mirabilis* kaum zu unterscheiden, und nur daran zu erkennen dass der Fleck geteilt ist.

Ischnodactylus bisetiger sp. nov. Tafel 2, Fig. 2.

Sehr flach, glänzend schwarzbraun, Vorderkörper etwas heller, Unterseite rotbraun, Fühler und Beine gelbbraun.

Der Kopf ist stark quer, die Augen sind ganz vorn am nächsten, während bei der vorigen Art die Innenecken breit verrundet sind, die grösste Breite also weiter, die Stirn hinaufgerückt ist, diese ist kaum halb so breit wie eines der stark vorquellenden Augen, beim Männchen ganz flach, beim Weibchen der Länge nach sehr schwach eingedrückt, in diesem Geschlecht deutlich punktiert, beim andern glatt. Im Nacken entspringen zwei haardünne, flachgedrückte, zuerst dem Kopf anliegende, wie angeklebte, sehr lange Hörner, die nach vorn leicht gebogen sind, sie sind bis zum Grunde gleich dünn. Der Vorderkopf ist auffallend kurz, die Wangen sind fast geradlinig stark verengt, die Länge des Epistoms (also von vorn nach hinten gemessen) ist kaum grösser als die schmalste Stelle der Stirn zwischen den Augen. Vor diesen befindet sich auf den Wangen ein starker Eindruck, welcher den Rand aufbiegt. Die Vorderecken ragen schwach vor, dadurch erscheint das Epistom leicht ausgebuchtet, seine Mitte ist beim Männchen leicht winklig angedeutet. Der Vorderteil des Kopfes ist in beiden Geschlechtern fein und deutlich punktiert. Die Fühler sind schlank, Glied 3 gleich 4, dieses ist leicht verdickt, die folgenden sind sämtlich rundlich erweitert, so breit wie lang. Das Kinn hat beim Männchen eine starke, behaarte Grube.

Der Halsschild ist sehr flach, reichlich doppelt so breit wie in der Mittellinie lang, der basale Mittellappen ist kurz, die Seiten sind zuerst schwächer, dann stärker nach vorn verengt. Die Hinterecken sind scharf rechtwinklig, Eindrücke an den

Seiten fehlen, nur die basalen sind sehr deutlich, die Punktierung ist sehr fein und oberflächlich.

Die Flügeldecken haben einen durchscheinenden Rand, die Skulptur ist wie bei voriger Art, nur die Fleckenbildung ist anders. Es finden sich ebenfalls auf jeder Decke drei Flecken: ein rundlicher im letzten Drittel, der den dritten und vierten und einen grossen Teil des zweiten Zwischenraumes einnimmt; ein zweiter Fleck liegt vor dem ersten Drittel, er ist ebenfalls rund oder schwach dreieckig und geht über den dritten und vierten bis in den fünften Zwischenraum; der dritte Fleck ist länglich, manchmal undeutlich, und findet sich im achten Zwischenraum dicht hinter der Schulter. Auf dem vorderen Fleck sind die Zwischenräume nicht verbreitert. Unterseite und Beine zeigen gegen die vorige Art keine Abweichungen.

Länge, 5.9 bis 6.8 Millimeter; Breite, 3 bis 3.5.

Zwei Männchen und 9 Weibchen in den Sammlungen Stettin, Dahlem, und Gebien.

Sumatra, Soekaranda, Januar, 1894 (*Dohrn*); Tebing-tinggi (*Schultheiss*).

Von allen Arten durch die Anordnung der Flecken geschieden. Von der sehr ähnlichen vorigen Art durch die Kopfbildung leicht zu unterscheiden; es fehlt eine Längsfurche auf der Stirn, das Epistom hat kein Zähnchen, aber es finden sich zwei haardünne lange Hörner auf dem Hinterkopf. *Ischnodactylus mirabilis* und *batesi* haben ein eckig vorgezogenes Epistom und andere Fleckenbildung.

Ischnodactylus quadrioculatus Chevrolat. Tafel 2, Fig. 3 und 4.

Ischnodactylus quadrioculatus CHEVROLAT, Pet. Nouv. Ent. 2 (1877) 178.

Ischnodactylus quadridentatus CHEVROLAT, Pet. Nouv. Ent. 2 (1877) 173.

Ich habe die Type dieser Art nicht gesehen. Ihre Deutung auf die mir vorliegenden Stücke von Java ist also nicht ganz ohne Zweifel. Nach diesen gebe ich eine neue Beschreibung:

Sehr flach, oval, Flügeldecken schwarz, Vorderkörper, Unterseite, Beine, und Fühler schwarzbraun, zwei Flecke auf jeder Flügeldecke hell gelb.

Kopf beim Männchen ohne Horn, so breit wie lang, die Augen quellen seitlich stark vor, sie sind schräg nach vorn gerichtet, vorn einander am nächsten, die Stirn zwischen ihnen ist beim Männchen fast so breit, beim Weibchen so breit wie ein Auge

von oben gesehen. Eine eigentliche Furche fehlt auf der Stirn, doch finden sich zwei feine Längsfältchen, die hinten etwas stärker erhaben sind. Der ganze Kopf ist in beiden Geschlechtern fein und oberflächlich punktiert, der Vorderkopf ist sehr lang, die Seiten sind geradlinig nach vorn verengt, die Ecken beim Männchen breit verrundet, beim Weibchen deutlich, das Epistom ist in ersterem Geschlecht stark aufgebogen und in der Mitte sehr stumpf gewinkelt, beim Weibchen schwach aufgebogen und in der Mitte gerade abgestutzt. An den Fühlern ist Glied 3 etwas länger als 4, 5 und die folgenden sind so breit wie lang. Das Mentum des Männchens hat eine runde, schlecht begrenzte, aber tiefe Grube, in deren Zentrum ein Haarpinsel steht.

Pronotum auffallend flach, mit vorragenden, von oben gesehen ziemlich spitzen, in der Randkante sehr kurz verrundet rechtwinkligen Vorderecken, die Hinterecken sind 90° gross, die Seiten schwach gebogen, in der Endhälfte fast parallelseitig, der Vorderrand ist kräftig ausgeschnitten. Die grösste Breite ist 2.5 mal so gross wie die Länge in der Mitte gemessen, ausser dem basalen Grübchen findet sich ein sehr flacher Eindruck am Seitenrand. Die Punktierung ist deutlich, aber fein und oberflächlich.

Die Flügeldecken sind hinter der Schulter etwas rundlich erweitert, mit ganz flachen, sehr fein, aber deutlich punktierten Zwischenräumen, die seitlichen sind nur leicht gewölbt. Die Flecken sind bei dieser Art sehr gross, die vorderen so gross wie der schwarze Raum vor ihnen, sie nehmen die Zwischenräume 3, 4, und 5 ein und gehen auch auf 2 und 6 über, 3 und 5 sind dort verbreitert. Der hintere Fleck ist bei den mir vorliegenden Tieren etwas verschieden, er ist ebenfalls fast kreisrund und reicht vom zweiten bis zum fünften oder siebenten Zwischenraum. Der verflachte Seitenrand ist hinten kaum verbreitert.

Die Unterseite ist beim Männchen kaum behaart, Haarflecken und Pinsel fehlen, die Hinterschienen sind bis zum Ende fast linear, an den Hintertarsen ist das erste Glied etwas kürzer als der Rest.

Länge, 7.5 bis 8.5 Millimeter; Breite, 3.8 bis 4.2.

Ein Pärchen von Java, Arjuno (*Doherty*) und ein Weibchen mit auffallend grossen Flecken, ohne Fundort, in meiner Sammlung. Ein weiteres Weibchen, ebenso wie das zuletzt erwähnte gefleckt, in der Sammlung Veth mit dem Fundort Java.

Diese Art ist an den grossen Flecken leicht kenntlich und ausserdem durch die Kopfbildung des Männchens, dem die

Hörner fehlen, ausgezeichnet. Dieses letztere Merkmal zeigt auch *I. sexguttatus*, hat aber ganz andere Zeichnung und besonders seitlich stark gewölbte Zwischenräume.

Ischnodactylus sumbawicus sp. nov. Tafel 2, Fig. 5.

Flach, oval, glänzend schwarz, die Ränder der Decken, die beiden ersten Fühlerglieder, und die Tarsen (an den Hinterbeinen nur die letzten drei Glieder) braun.

Der Kopf ist stark quer, die Augen quellen sehr stark vor, sie sind schräg nach vorn gerichtet, ganz vorn am nächsten aneinander stossend, dort ist die Stirn kaum halb so breit wie ein Auge oben, leicht vertieft, nicht eigentlich gefurcht, hinten ohne Auszeichnung. Der Vorderkopf ist in ungefähr ein Drittelkreisbogen verrundet, die Vorderecken vollständig geschwunden, das Epistom nur auf kurze Strecke gerade. Vor den Augen befindet sich ein tiefer, breiter Eindruck, wodurch die Wangen leicht aufgebogen erscheinen, das Epistom ist aber ganz flach. Die Punktierung (Weibchen) ist zwischen den Augen etwas gröber als vorn. An den Fühlern ist Glied 3 gleich 4, dieses ist aber schon verdickt, etwas länger als breit, die folgenden sind sämtlich quer, das letzte ist oval.

Der Halsschild ist über 2.5 mal so breit wie lang, mit sehr kleinem basalen Mittellappen. An der Basis finden sich zwei rundliche Grübchen und neben dem Seitenrand ein wenig deutlicher, flacher Eindruck. Die Seiten sind zuerst fast geradlinig, dann stärker nach vorn verengt, die Vorderecken sind breit verrundet, der Vorderrand ist flach ausgeschnitten, die Punktierung ist deutlich, aber fein und oberflächlich.

Die Flügeldecken haben in der Gestalt nichts Abweichendes und weisen die gewöhnlichen, äusserst feinen Punktlinien auf. Alle Zwischenräume sind ganz flach, nur hinten sind die äusseren leicht vertieft. Die Zeichnung ist charakteristisch: der vordere Fleck ist sehr breit und bildet eine Binde, welche vorn etwas zackig ist, sie lässt nur den Seitenrand und den ersten Streifen ganz, den zweiten zum Teil frei. Der Raum von der Binde bis zur Basis ist viel schmaler als die Binde. Der sehr grosse Hinterfleck lässt die beiden äusseren Zwischenräume ganz und die ersten zum Teil frei. Der dritte Zwischenraum ist auf dem Vorderfleck schwach, der fünfte deutlicher verbreitert. Unterseite und Beine zeigen nichts Bemerkenswertes. An den Hintertarsen ist Glied 1 kaum kürzer als der Rest.

Länge, 7 Millimeter; Breite, 3.7.

Ein Weibchen von Sumbawa, in meiner Sammlung.

Diese Art erinnert am meisten an *I. quadrioculatus*, besonders wegen der Grösse der Flecken, doch ist sie etwas kleiner, der Vorderkopf ist nicht trapezisch sondern kreisbögig, auf der Stirn fehlen die Längskielchen, die Vorderecken des Pronotums treten nicht winklig vor, ferner ist bei unserer Art der vordere Fleck zu einer breiten Binde ausgebildet, was sich bei keiner andern wiederfindet, auch sind Ober- und Unterseite schwarz statt braun.

Ischnodactylus unifasciatus sp. nov. Tafel 2, Fig. 6.

Oval, mässig flach, glänzend schwarzbraun, Decken mit einer gelben Binde vorn, ohne Spitzenfleck, Unterseite hellbraun, Fühler und Beine gelbrot.

Der Kopf ist viel breiter als lang, die Stirn ist vorn viel schmaler als ein Auge von oben gesehen, sie ist etwas vertieft aber der ganze Grund vollkommen eben, nur die Ränder hart am Auge etwas erhabener. Beim Männchen finden sich auf der Stirn in der Mittellinie zwei äusserst feine Längsfältchen unter den Hörnern, beim Weibchen ist die Stirn flach und sehr deutlich punktiert. Die Wangen sind geradlinig und stark verengt, das Epistom ist vorn breiter als die schmalste Stelle der Stirn, es ist auch beim Männchen gerade abgestutzt, flach angedrückt. Die Hörner des Männchens scheinen unter dem Vorderrand des Pronotums zu entspringen, sie liegen flach an und sind fast gerade, am Grunde nicht verwachsen, sehr schmal, zuerst verflacht, aber nach aussen nicht verbreitert, dann stielrund, am Ende ohne Haarschopf. Die Fühler sind in den Geschlechtern recht verschieden: beim Männchen sehr lang, alle Glieder sehr gestreckt, Glied 3 ist etwas länger als 4, beide sind fast zylindrisch, die folgenden sind lang gestreckt oval, über doppelt so lang wie breit, die vorletzten noch immer doppelt so lang wie breit; beim Weibchen ist Glied 3 viel länger als 4, dieses und die folgenden sind etwas länger als breit, schwach konisch. Das Mentum wird beim Männchen von einer tiefen Grube eingenommen, die behaart ist und vorn einen spitzen Haarschopf trägt.

Der Halsschild ist an der Basis 2.5 mal so breit wie in der Mittellinie lang, die Seiten sind im Enddrittel parallel, die vordere Wölbung ist sehr flach und geht direkt bis zur Randkante. Es sind nur die beiden basalen Eindrücke vorhanden, die Hinterecken sind scharf stumpfwinklig, die vorderen verrundet, die Punktierung ist beim Weibchen viel stärker als beim Männchen.

Die Flügeldecken sind nicht sehr flach, der Seitenrand ist von oben breit sichtbar, er ist nach hinten nicht verbreitert,

die Seiten sind hinter der Schulter nur schwach erweitert. Die Punktreihen sind äusserst fein, die Zwischenräume vorn ganz flach, nur die äussersten auch dort gewölbt, hinten sind die Punktreihen furchig. Auf der Binde vorn sind die Zwischenräume 3 und 5 nur undeutlich breiter als die andern. Es ist nur eine helle Binde vorhanden, ein Spitzenfleck fehlt, diese Binde ist etwa so breit wie der dunkle Raum vor ihr an der Basis, sie lässt nur den ersten und letzten Zwischenraum frei und verbreitert sich auf dem dritten und fünften nach vorn und hinten etwas zackenförmig.

Die Unterseite ist auch beim Männchen nackt, das Prosternum vorn deutlich gekielt. An den Hintertarsen ist Glied 1 deutlich kürzer als der Rest.

Länge, 5.5 bis 8 Millimeter; Breite, 3 bis 4.

Ein Männchen und 8 Weibchen im Museum Berlin und in meiner Sammlung.

Ober-Assam (*Hartert* leg.).

Abgesehen von der Zeichnung, die recht abweichend ist, unterscheidet sich unsere Art durch die auffällig langen Fühlerglieder, namentlich beim Männchen. Uebrigens ist auch die Hornbildung beim Männchen charakteristisch, sie erinnert am meisten an die von *I. mirabilis* bei dem sie aber zuerst dem Kopfe anliegen und sich dann erheben. Am nächsten steht unserer Art die folgende, die sich wenig unterscheidet.

Ischnodactylus formosanus sp. nov.

Die ausführliche Beschreibung der vorigen Art passt genau auf diese, so dass ich auf sie verweisen kann. Die Unterschiede sind folgende:

Oberseite glänzend schwarz, die Hörner des Männchens liegen zuerst auf kurze Strecke dem Kopf an und sind daher schwach S-förmig gekrümmt, die Fühlerglieder des Männchens sind nur wenig länger als breit, unter den Hörnern fehlt das zarte Längsfältchen, beim Weibchen ist die Stirn fast glatt. In beiden Geschlechtern ist die helle Querbinde der Decken viel schmaler als der dunkle Raum vor ihr, sie geht innen kaum bis auf den zweiten Zwischenraum, den sie bei der vorigen Art ganz einnimmt.

Länge, 7 bis 7.2 Millimeter; Breite, 3.7 bis 3.8.

Zwei Männchen und 1 Weibchen im Museum Berlin, von denen mir ein Männchen freundlichst für meine Sammlung überlassen wurde.

Formosa, Hoozan, Januar, 1910; Fuhosho, Juli, 1909 (*Hans Sauter*).

Ischnodactylus bisbifasciatus sp. nov. Tafel 2, Fig. 7.

Auch diese Art ist dem *I. unifasciatus* recht ähnlich, ebenso der vorigen, aber sicherlich artlich verschieden durch folgende Merkmale:

Flügeldecken mit je zwei Binden, die vordere ist so breit wie die dunkle Basis vor ihr, im dritten und fünften Zwischenraum nach vorn und hinten etwas verbreitert, sie lässt die beiden ersten und die beiden äussersten Zwischenräume frei, die hintere, ungezackte, vor der Spitze, geht nach vorn und aussen etwas schräg und reicht auch auf den zweiten Zwischenraum. Die Hörner des Männchens sind gerade, kurz, und verflacht, unter ihnen befindet sich kein Längsfältchen. Die Unterseite ist in diesem Geschlecht auf dem Pro- und Mesosternum leicht und nicht deutlich punktiert.

Länge, 4.9 bis 6 Millimeter; Breite, 2.5 bis 3.1.

Ein Pärchen im Museum Berlin.

Formosa, Fuhosho, Juli, 1909 (*Sauter*).

Ischnodactylus pictipennis sp. nov. Tafel 2, Fig. 8.

Oval, Hinterkörper verhältnismässig stark gewölbt, Oberseite glänzend schwarz, oder bei mehr unreifen Stücken braun, Flügeldecken mit je zwei gelben Binden.

Der Kopf ist beim Männchen ungehörnt, das Epistom nicht vorgezogen, sondern mehr wie bei *Platydemia* gebildet. Die Stirn ist beim Männchen der Länge nach kräftig eingedrückt, die Augen treten nahe zusammen, der Zwischenraum vorn ist beim Männchen ungefähr halb so gross wie das dritte Fühlerglied lang, beim Weibchen etwas grösser, hart am Auge liegt ein kräftiger Quereindruck. Der Vorderkopf ist kurz, viel kürzer als bei den meisten andern Arten, das Epistom ist gerade abgestutzt, die Ecken sind deutlich und liegen vor der Mitte der Augen. Der Clypeus ist querüber sanft gewölbt, aber der Rand ist nicht aufgebogen, ein Zähnchen vorn fehlt. Vor den Augen findet sich ein kräftiger Eindruck, die Länge des Clypeus ist etwas grösser als der Augenabstand vorn. Beim Weibchen findet sich nur ein leichter Eindruck auf der Stirn. Die Punktierung ist zwar fein, aber sehr deutlich. Die langen Fühler überragen beim Weibchen etwas, beim Männchen stark die Hinterecken des Pronotums, Glied 3 ist viel länger als 4, dieses ist noch doppelt so lang wie dick, 5 und 6 sind etwas dreieckig,

länger als dick, 7 so breit an der Spitze wie lang, 8 etwas quer, 9 stärker, 10 ist fast doppelt so breit wie lang, 11 nicht länger als breit. Beim Weibchen ist Glied 4 höchstens 1.5 mal so lang wie dick, 5 etwas quer, die folgenden werden immer stärker quer, sind aber nicht dreieckig sondern verrundet. Das Männchen hat auf dem Kinn hinten eine tiefe, rundliche Grube, die mit dichtem Haarpinsel versehen ist, beim Weibchen ist diese Grube sehr flach, auf dem Grunde vollkommen eben, sie randet hinten die Seiten und die Basis, ist über halbkreisförmig und vorn meist schlecht begrenzt.

Der Halsschild ist sehr flach, auch an den Seiten, 2.5 mal so breit wie lang, beim Männchen in der Mitte am breitesten, von dort nach hinten geradlinig schwach, aber deutlich verengt, nach vorn stark, beim Weibchen in der Endhälfte parallelseitig, die Hinterecken sind scharf rechtwinklig. Der Vorderrand ist, von oben gesehen, schwach ausgeschnitten, ganz leicht doppelbuchtig, da die Mitte sehr schwach vorgezogen ist, die Randung dort ist vollständig. Ausser den basalen Grübchen finden sich keine weiteren Eindrücke, die Punktierung ist sehr deutlich, ziemlich dicht.

Die Flügeldecken sind viel stärker gewölbt als der Halsschild, aber viel schwächer als bei den meisten Arten von *Platydemia*. Es sind zwei Binden vorhanden: die vordere liegt vor der Mitte, ist sehr schmal, gezackt, sie lässt den Seitenrand schmal und den ganzen Nahtstreif frei, sie sendet im dritten Zwischenraum einen längeren, im siebenten einen kürzeren Ast nach vorn und im fünften nach hinten. Die hintere Binde ist nicht quer, sondern vom Seitenrand, wo sie sehr breit ist, schräg nach innen und vorn gerichtet, lässt ebenfalls den Nahtstreif frei. Von den beiden Binden hinten wird ein beider Decken gemeinsamer, ungefähr kreisförmiger Raum eingeschlossen. Die Punktreihen sind sehr fein, ihre Punkte stehen dicht, der dritte Raum ist weiter vorn, der fünfte weiter hinten auf der vorderen Binde wesentlich breiter als die andern. Alle Zwischenräume, auch die der Seiten sind ganz eben, sehr fein, aber deutlich punktiert.

Die Unterseite ist in beiden Geschlechtern nackt, das Prosternum nach vorn sehr schwach gesenkt, zwischen den Hüften oft längsgefurcht. An den Hintertarsen ist Glied 1, an der Sohle gemessen, so lang wie der Rest, von oben gesehen deutlich kürzer.

Länge, 8 bis 10 Millimeter; Breite, 4.5 bis 5.

Malacca, Perak (*Jachau*, ferner *Grubauer*). Sumatra, Soekaranda (*Dohrn*); Deli, Ober Langkat (*Ude*).

In den Sammlungen Stettin, Berlin, München, und Gebien.

In der Zeichnung weicht unsere Art von allen andern ab. Sie bildet wegen des Kopfbaues eine gewisse Ausnahme in der Gattung; es fehlen die den meisten Arten charakteristischen Hörner des Männchens; ferner ist das Epistom weder vorgezogen noch aufgebogen. In der Zeichnung erinnert sie etwas an *I. bisbifasciatus*, aber die auch aussen ganz flachen Zwischenräume, die sehr lange, stark gezackte, schmale vordere und die eigentümliche Form der hinteren Binde unterscheiden beide Arten leicht. Hörner fehlen auch bei *I. sexguttatus*, der aber in Zeichnung und Skulptur ganz abweichend ist, ferner bei *quadrioculatus*, der beim Männchen ein vorgezogenes und aufgebogenes Epistom hat.

Genus **HOPLOCEPHALA** Castelnau und Brülle

Hoplocephala CASTELNAU und BRÜLLE, Ann. Sc. Natur. (1829) 338.¹

Diese Gattung ist mehrfach und recht ausführlich beschrieben, aber fast immer nur von Faunisten welche nur die wenigen Arten einer Fauna vor sich hatten. Die besten Beschreibungen sind aufgebaut auf die eine europäische Art *H. haemorrhoidalis*. Diese ist in der Tat durch gute Merkmale von der nahe verwandten Gattung *Platydema* getrennt. Die meisten Autoren aber scheinen alle mehr oder minder zylindrisch gebaute Diaperinen in unsere Gattung gestellt zu haben. So sind die Gattungsscharaktere sehr verwischt. In der Tat sind die Merkmale leider recht schwankend. Da aber unsere Fauna sehr arm an *Hoplocephala*-Arten ist, kann es hier nicht meine Aufgabe sein den Inhalt der ganzen Gattung kritisch zu beleuchten; das muss späterer Arbeit vorbehalten bleiben. Von allen asiatischen Arten die als *Hoplocephala* beschrieben wurden, ist mir nur eine bekannt geworden, *H. ferruginea* Motschulsky (nec Lec.) = *orientalis* Gebien, und ich stellte fest dass sie zu der Gattung *Platydema* zu stellen ist, trotz ihres zylindrischen Körpers. Da es leider schon ein *Platydema ferrugineum* Chevrolat gibt, muss abermals eine Umtaufe stattfinden. Es ist also zu zitieren: *Platydema ferrugineum* Motschulsky, India Oriental, syn. *orientale* Gebien; *Platydema biimpressum* Chevrolat, Amerika Central, syn. *ferrugineum* Chevrolat.

Von den übrigen asiatischen Arten scheint nur *H. asiatica* Lewis wirklich zur Gattung zu gehören, die der europäischen Art *H. haemorrhoidalis* aufs nächste verwandt ist. Von den andern Arten die Motschulsky in die Gattung stellt gehört vielleicht nicht eine einzige hinein. Wegen der sehr geringen

¹ Weitere Litteraturangaben siehe Gebien, Col. Cat. pars 28.

Grösse würde ich versuchen die Arten als *Pentaphyllus* zu deuten, wenn der Autor nicht bei allen von gestreift punktierten Flügeldecken spräche, ein Charakter der *Pentaphyllus* nicht zukommt.

Hoplocephala tricornis sp. nov. Tafel 2, Fig. 9.

Ziemlich gross, zylindrisch, glänzend braun, Seiten der Flügeldecken und der Halsschild heller, Fühler und Beine gelbrot.

Der Kopf des Männchens ist auffällig gebildet, er ist hinten sehr tief ausgehöhlt, die Höhlung hinten scharfkantig begrenzt, die Kante in der Mitte leicht vorgezogen, die hintere Wand der Höhlung ist sehr hoch senkrecht, der Grund ist spiegelglatt. Der Vorderkopf ist ungefähr halbkreisförmig, doch ist das Epistom fast gerade. In der Mitte des Clypeus findet sich ein kräftiges, aber kurzes, rundes Hörnchen, das sehr dick und etwas konisch, aber nicht spitz ist. Innen, direkt am Auge, findet sich je ein starkes, nach aussen über das Auge gebogenes, rundes Horn das nackt ist, seine Aussenkante geht gerade auf das Auge, die Innenkante bildet nahe dem Grunde eine Ecke und ist darunter, nach der Grube zu, wieder eingezogen. Bei dem schwächer entwickelten Männchen sind die Hörner kurz, bilden mehr starke Tuberkeln, die Grube ist nicht so tief, hinten nicht scharfkantig begrenzt und deutlich punktiert. Die Fühler sind schlank, Glied 3 ist länger als 4, von diesem an sind die Glieder erweitert, locker aneinander gesetzt, das vierte ist so breit wie lang, die vorletzten sind ungefähr 1.5 mal so breit wie lang. Die Wangen sind etwas schmaler als die Augen, der Hals ist sehr dick, das Mentum ist gewölbt; die Augen sind vom Maxillarausschnitt durch einen ziemlich breiten, blanken Zwischenraum getrennt. Das Endglied der Maxillarpalpen ist breit zylindrisch, an der Spitze schräg abgeschnitten, die Seiten sind allerdings kurz parallel.

Der Halsschild hat stark gerundete Seiten, die senkrecht abfallen, der Vorderrand ist seicht ausgeschnitten, die Basis in der Mitte mit feinem, aufgebogenen Rand, aber nicht mit Randlinie versehen. Die basalen Grübchen sind flach, die Ecken breit verrundet, besonders die hinteren.

Die Flügeldecken sind zylindrisch, ihre Seiten senkrecht, die Randkante ist von oben gerade überdeckt. Die ersten Punktreifen, besonders der Nahtstreif, sind vertieft, hauptsächlich hinten, die Zwischenräume sind leicht gewölbt, ausserordentlich fein und dicht punktiert, hinten verbindet sich Streifen 3 mit 8 oder nähert sich ihm stark.

Die Unterseite ist braun, das Prosternum zwischen den Hüften schmal, hinten niedergedrückt und dann mit Fortsatz versehen, der kurz ist aber senkrecht abfällt. Das Mesosternum ist V-förmig ausgeschnitten, der Abdominalfortsatz ziemlich schmal. Das Abdomen ist blank, kräftig und nicht eng punktiert. Die Schienen sind gerade, aussen mit scharf krenulierter Kante versehen. An den Hintertarsen ist Glied 1 etwas länger als 2 und 3 zusammen.

Länge, 6 Millimeter; Breite, 2.8.

Zwei Männchen im Museum Leyden, von denen mir eines für meine Sammlung überlassen wurde.

Nordöstliches Sumatra, Serdang, Tandjong Morawa (Hagen).

Ich habe lange geschwankt ob ich diese Art zu *Hoplocephala* oder zu *Platydema* stellen sollte; sie bildet einen Uebergang zwischen beiden. Mit der ersteren Gattung stimmt sie überein in der zylindrischen Gestalt, dem fast walzenförmigen Endglied der Maxillarpalpen, der fein gerandeten (das heist, aufgebogenen) Halsschildbasis, dem niedergedrückten Prosternum. An *Platydema* gemahnen das V-förmig ausgeschnittene Mesosternum und die gekerbt-gekielten Schienen.

Genus MARTIANUS Fairmaire

Martianus FAIRMAIRE, Ann. Soc. Ent. Belg. 37 (1893) 540.

Tenebriomimus KOLBE, Allg. Zeitschr. Entom. 6 (1901) 342.

Diese Gattung wurde von Fairmaire auf eine Art von den Comoren gegründet; als zweite Art stellte er den *Histeropsis dermestoides* Chevrolat von Indo-China und den Viti Inseln hinein. Den Typus der Gattung, *Martianus castaneus*, habe ich jetzt in Anzahl von den Comoren vor mir gehabt. Mit dieser Art fallen *Tenebriomimus adansoniarum* Kolbe und *Hoplocephala longula* Gebien, beide von Ostafrika, zusammen.

Ueber die systematische Stellung der Arten hat mehrfach Zweifel geherrscht. Chevrolat stellt seine Art *dermestoides* in die Untergattung *Histeropsis* von *Platydema*, also zu den Diaperiden. Ueber seine Auffassung der Art wird noch weiter unten die Rede sein. Fairmaire stellt, 1893, dieselbe Art fraglich zu *Alphitobius*, also zu den Ulomiden. Aber in demselben Jahre stellt er seine Gattung *Martianus*, in die er doch auch *dermestoides* bringt, trotzdem er die Aehnlichkeit mit *Alphitobius* betont, neben *Hoplocephala* zu den Diaperiden. Später bringt Chatanay sie wieder zu den Ulomiden. Ich selbst habe die afrikanische Art, die ich jetzt für identisch halte mit *M. castaneus*,

als *Hoplocephala* beschrieben. Aber an anderer Stelle habe ich *Martianus dermestoides* zu den Ulomiden gestellt. Man sieht, die Sache ist nicht leicht zu entscheiden. Habituell steht die Gattung dem *Alphitobius* sehr nahe. Aber ich halte als das entscheidende Kriterium die Schienbildung für ausschlaggebend. *Martianus* hat, wie die meisten Diaperinen, fein krenulierte, das heist, mit gekerbtem Kiel versehene Schienen, ein Merkmal das wir bei Ulomiden nicht finden. Ueberdies ist auch der Fühlerbau ganz wie bei *Platydema*, da die Glieder vom vierten respektiv fünften an erweitert sind, ohne eine Keule zu bilden.

Ich habe in einer früheren Arbeit³ ausgeführt dass unmöglich *Histeropsis dermestoides* Chevrolat von den Viti Inseln und *Alphitobius* (?) *dermestoides* Fairmaire von Indo-China auf die gleiche Art bezogen werden können. Chevrolat's Art ist 10 Millimeter lang, das Männchen ist gekörnt; Fairmaire's Art dagegen ist 6 Millimeter lang und das Männchen ungehörnt. Ausserdem stammt die erstere von den Viti Inseln, die andere aus Asien, sind also geographisch weit getrennt. Der Widerspruch wäre nicht zu klären, wenn wir nicht mit Chevrolat's oft bewiesener Nachlässigkeit rechnen würden. Ich glaube die Grössenangabe ist falsch (10.5 : 2.5 Millimeter), denn das würde auf ein ausserordentlich langgestrecktes Tier deuten, ungefähr von der Gestalt eines *Hypophloeus*, während der Verfasser in der Beschreibung doch ausdrücklich das Tier "elongato-oblongus" nennt, und das passt auf die Grösse 6 : 2.5 Millimeter. Ueberdies liegen mir aus der ehemaligen Sammlung Haag die Typen von den Viti Inseln vor, die mit Fairmaire's Deutung übereinstimmen. Unerklärlich aber ist mir, wie der Autor die Art gekörnt nennen kann. Von den circa 100 Tieren die ich untersuchte, ist nicht eines gekörnt. Möglicherweise hat der Autor ein Artefakt vor sich gehabt, das er für das Männchen hält, oder aber das Männchen einer ganz andern Art mit *dermestoides* vermengt.

Die Unterschiede zwischen *Martianus* und den verwandten Gattungen sind in der Tabelle auseinandergesetzt.

Martianus dermestoides Chevrolat.

Martianus dermestoides CHEVROLAT, Pet. Nouv. Ent. 2 (1877) 242;
FAIRMAIRE, Ann. Soc. Ent. Fr. (1893) 28; GEBIEN, Saraw. Mus.
Journ. 2 (1914) 33.

Diese Art ist in Süd China, dem indo-malayischen und papuanischen Gebiet weit verbreitet und scheint häufig zu sein. Sie ist

³ Bull. Saraw. Mus. 2 (1914) 33, 34.

an dem gestreckten Körper, der an einen lang gezogenen *Alphitobius* erinnert, an der braunen oder schwarzbraunen Oberseite, den grossen Augen, den vom vierten Gliede an erweiterten Fühlern zu erkennen. Das Mesosternum ist ausgeschnitten, doch sind die Ecken verrundet, das erste Glied der Hintertarsen ist verlängert, das Endglied der Maxillarpalpen fast zylindrisch.

Indo-China, Saigon, Pnom Penh. Süd China, Provinz Fokien. Java Occidental, Soekaboemi, 2,000 Fuss (*Fruhstorfer*). Banguey bei Borneo. Aru-Inseln (*Beccari*). Deutsch Neu-Guinea. Viti Inseln.

In den Sammlungen Dahlem, Hamburg, Gebien, über 100 Exemplare. Wahrscheinlich in allen Sammlungen, aber für Ulomiden gehalten.

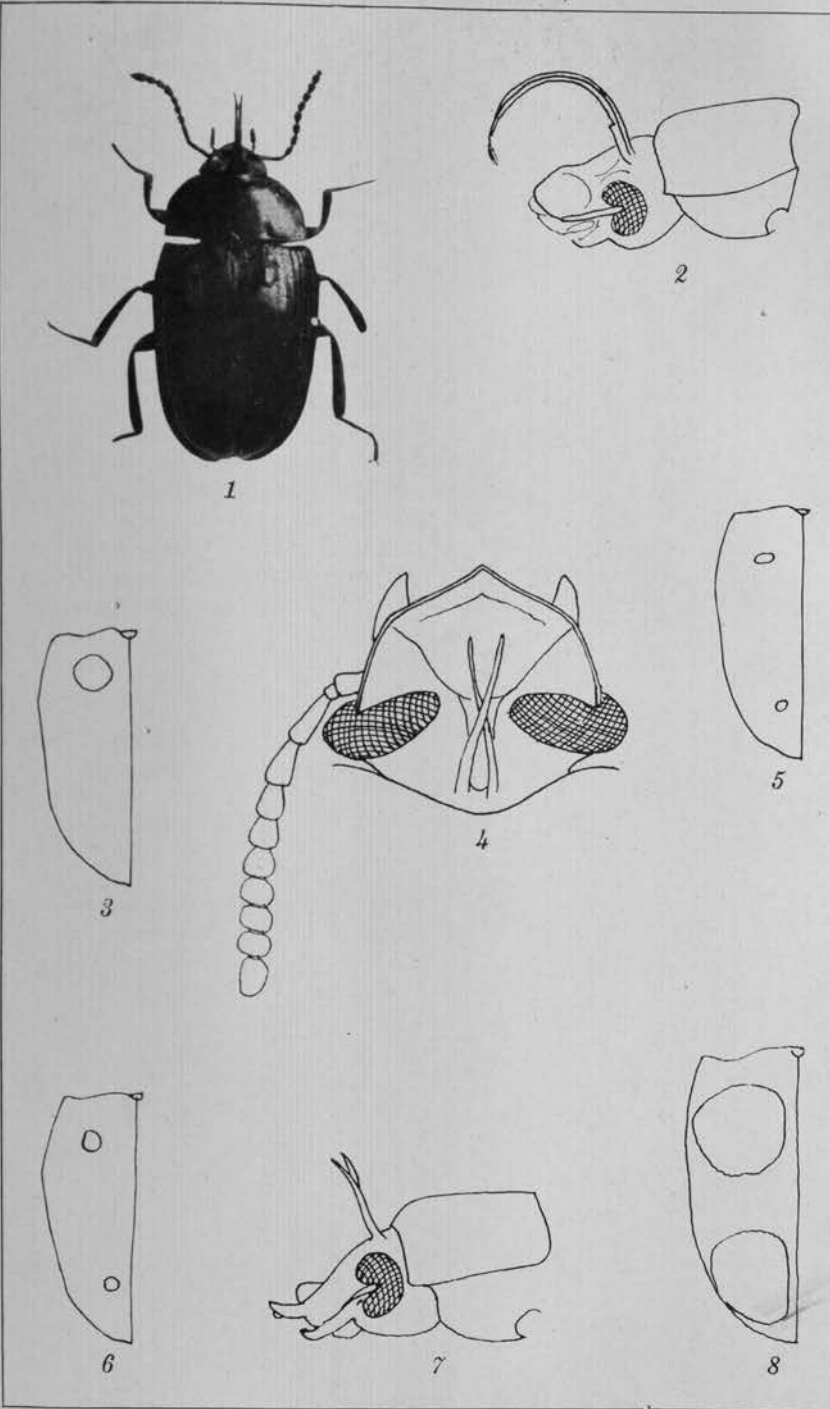
ILLUSTRATIONEN

TAFEL 1

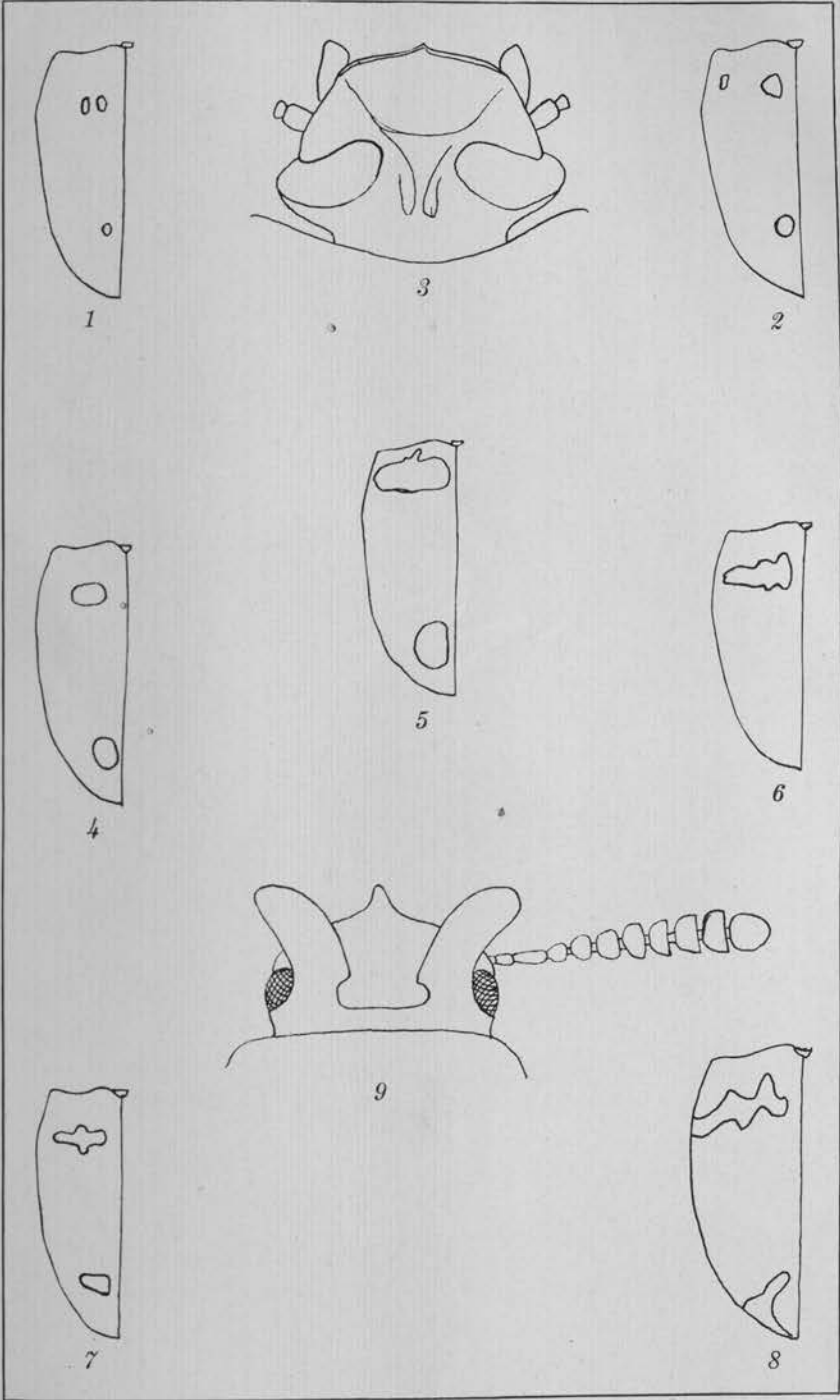
- FIG. 1. *Ischnodactylus colon* sp. nov.
2. *Ischnodactylus colon* sp. nov. Kopf.
3. *Ischnodactylus rubromarginatus* Chevrolat. Deckenzeichnung.
4. *Ischnodactylus mirabilis* Gebien. Kopf.
5. *Ischnodactylus mirabilis* Gebien. Deckenzeichnung.
6. *Ischnodactylus batesi* Chevrolat. Deckenzeichnung.
7. *Ischnodactylus nasutus* sp. nov. Kopf.
8. *Ischnodactylus fenestratus* sp. nov. Deckenzeichnung.

TAFEL 2

- FIG. 1. *Ischnodactylus serguttatus* sp. nov. Deckenzeichnung.
2. *Ischnodactylus bisetiger* sp. nov. Deckenzeichnung.
3. *Ischnodactylus quadrioculatus* Chevrolat. Kopf des Männchens.
4. *Ischnodactylus quadrioculatus* Chevrolat. Deckenzeichnung.
5. *Ischnodactylus sumbawicus* sp. nov. Deckenzeichnung.
6. *Ischnodactylus unifasciatus* sp. nov. Deckenzeichnung.
7. *Ischnodactylus bisbifasciatus* sp. nov. Deckenzeichnung.
8. *Ischnodactylus pictipennis* sp. nov. Deckenzeichnung.
9. *Hoplocephala tricornis* sp. nov. Kopf eines wohlentwickelten Männchens.



TAFEL 1.



TAFEL 2.